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The Teaching of Home Mechanics

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THE widespread adoption of the general-shop idea in the teaching of industrial-arts activities by the schools throughout the country has been very rapid. This has been especially true in the smaller community where the problem of presenting contacts with many trade groups at a minimum expense has been solved by the equipping of one shop in such a manner that various lines of work could be carried on at the same time by a single teacher. The teaching of the several kinds of work simultaneously amounts to the conducting of several classes or groups at the same time and, therefore, requires a different teaching technique than has been employed in the teaching of a traditional shop class. Home-mechanics teaching due to the unusually large range of tools and materials used is one of the general shop courses, which, if taught effectively, requires careful planning as to selection of content, shop organization, and methods of teaching. It is the purpose of the writers of this article to set down their experiences in the teaching of home mechanics in the hope that a solution of some of the teaching problems of this work may be suggested.

The plan of home mechanics in the industrial-arts program of a school system effects the purposes for which it is taught. In some systems it is offered with the definite purpose in mind of teaching home repairs and constructions, and developing the ability to understand and operate home devices. Other systems may offer it with guidance purposes in mind, extending the course over a longer time and making use of the varied trade group activities under which the jobs fall in giving training in the use of tools, materials, and processes, thus covering many fields of shop endeavor. Again a combination of both of these purposes may be in mind when organizing the course.

The content taught will, of course, be different for each community, and it must be selected according to the purposes for teaching and to best suit the local needs. The content may be selected from published studies, from a local survey, or the course may be organized around sets of published job sheets. The use of any of the above plans for selecting content should not, however, be thought of as sufficient. A course of study to guide the teachers covering the following points should be fully prepared:

1. Course objectives.
2. Time devoted to shopwork, demonstrations, lectures, and class discussion.
3. A statement of method common to all units of work.
4. Units of work outlined.[1]

An organization of content material that has been found to be very effective has been arranged under the following units:

1. Woodwork and related repair.
2. Wood finishing.
3. Plumbing.
4. Electrical construction and repair.
5. Bench metal.
6. Miscellaneous repair.

The teacher of home mechanics is confronted with the task of making his selection from a very large number of possible jobs that come under the head of home repair and maintenance, as it is plainly evident that time will not permit the boy to do more than a small number of those that might be listed. There are several ways that the selections may be made. The course objectives and shop facilities will determine the best plan.

1. A pupil may be required to do a certain minimum number selected from a required list.
2. A required list and a supplementary list may be used.
3. A pupil may be permitted a free selection of jobs irrespective of trade grouping.
4. A pupil may be permitted selection under guidance so that a complete covering of the various trade groupings may be secured.

In a definite home-repair and maintenance plan, a job brought in from the home should take precedence over a shop assignment.

The ordinary size of class taught makes it imperative that some sort of teaching aids be used to supplement the work of the teacher. This instructional material may be purchased or written by the teacher and duplicated by the school for distribution. Where published sheets cover the jobs to be taught they are usually to be preferred over locally prepared material as they are, in most cases, more carefully worked out and the steps liable to give trouble are cleared up by diagrams and photographs. The ideal plan is to have

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[1]Outline of units of work given in detail in "Curriculum Building," INDUSTRIAL-ARTS MAGAZINE, March, 1929, H. B. Nash and Roy R. Van Duzee.

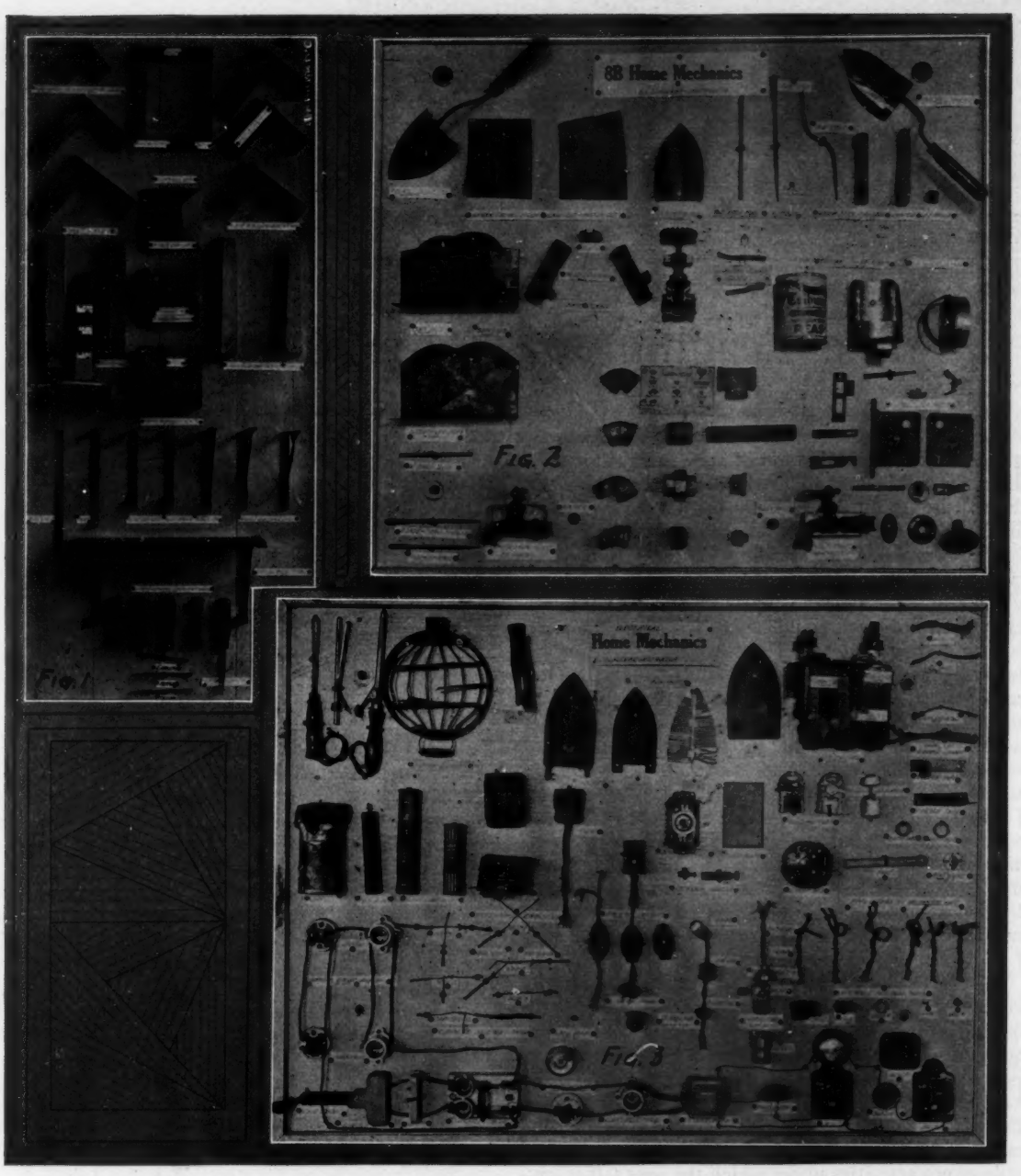

Figure 1 illustrates the use and application of corrugated fasteners, corner braces, and mending plates on joints. In the top center of the panel is a glazing frame showing the back putty, glazier points, sash light, and the finished putty in place.

In the center are the steps in constructing a lamp from the rough stock to the finished product. From the left to the right is shown the stock for the upright, the completed lamp assembled, showing the following steps in finishing: the preparation of the wood, stain, two coats of shellac, two coats of varnish, and the varnish pumiced and polished, stock squared on four sides, and the hole bored, the two sides of upright tapered, and then the four sides tapered. In the center are the steps in making the base; first, the stock; second, stock squared and the two sides running with the grain chamfered; third, four sides chamfered and the center hole bored.

Below the lamp display from left to right are shown the bracket as follows: stock laid out, stock bent and curve started, the curve completed, holes drilled, the completed bracket, two brackets with turned brace and no curve, and below it the application of the bracket in the shelf construction. At the bottom are shown the steps in making a screw-driver handle from a broomstick: the stock, end of stock filed round, handle tapered to receive ferrule, ferrule in place, a screw driver complete. Below this are shown the drill rod, the stock from which the screw-driver bit is made, the forged tang and blade, the filed tang and blade ready for tempering.

At the top in Figure 2 is illustrated the making of a garden trowel. From left to right are shown the completed trowel looking at the back, stock for the blade, stock laid out and partly cut, the blade filed and shaped, the stock for the iron handle, stock ends forged into tang and flat end, the rod bent, broomstick stock for the handle, the handle filed ready for the ferrule, the ferrule and another view of a finished garden trowel.

In the left center of the panel are shown two types of sheet-iron book ends, the male and female hose coupling and clamp, and a section of a gate, valve showing its mechanism. Next are shown the steps necessary in making a round-leather-belt joint. The staple is shown, then a joint partly completed, and then the completed joint. Further to the right is a tin can, and a sugar scoop made from such a can, and at the extreme right is shown a biscuit cutter, also made from a tin can. At the lower left is another illustration of making a screw-driver bit. To the right is a section of a compression faucet showing its mechanism, and a compression washer. In the lower center of the panel is a display of common plumbing fittings such as the ell, 45-deg. ell, street ell, coupling, union, cap, tee, nipple, bushing, and the plug. At the lower right is shown a fuller ball, a section of a fuller faucet showing its mechanism and the parts of a common lock.

Figure 3 shows at the top from left to right the following: an electric curling iron with the heating element, a heating element illustrating the coil principle, the common flatiron parts such as, the handle, jacket, cover, coil, sole, and the plug. The two elements of a storage cell with the rubber insulators between the positive and negative plates, drop cord, rubber-covered wire, annunciator wire, and flexible conduit. Beginning again at the left below the electric curling iron is a dry-cell

FIG. 4

section showing the cardboard casing, zink cup, paper, paste, carbon stick, sand, sealing wax, and the positive and negative terminals in detail, the entire carbon stick, two different sizes of flashlight cells, radio-battery section, flatiron attachment piece, box receptacle, expansion shields, flush plate, which is partially covered by the hot-water heating pipe, porcelain push socket, porcelain insulator, rubber and friction tape, bushing, lock nut, outlet box, porcelain tube, and a miniature receptacle. In the lower left section of the panel from left to right is shown the following: a stairway hook-up using two 3-way switches and two base receptacles, the steps in making a western union and tap splice, insulated staple, a benjamin through switch, and 2-piece plug application, the base, swivel, and bushing of a benjamin swivel plug, the bushing, cap, underwriters knot, porcelain base and brass shell of a lamp socket, the steps in tying an underwriters knot, the shell, plug cartridge, collars and link of a refillable fuse plug. At the bottom of the panel are shown the construction, parts and operation of solid conduit piping, condulet and condulet covers, entrance switch with plugs, 1-way switch, base receptacle, transformer, push-button section, bell, and buzzer.

Figure 4 shows a class at work in the home-mechanics shop. Here are to be seen the display boards shown in Figures 1 and 3, as they appear mounted on the walls of the shop. Figure 2 is not visible, as it is on the opposite wall from which Figure 3 is located on.

each boy provided with his personal copy of all sheets. They may then be taken home for study and used later for home repair jobs. Another very satisfactory plan is to paste the sheets on tough cardboard and have them filed for use by the pupils in class. In the event that published sheets are used they will most probably need to be supplemented by sheets prepared by the teacher, inasmuch as many jobs will no doubt be included in the course which are not to be found in sets of published sheets.

The motto "A place for everything and everything in its place" forms the basis upon which a shop of so many varied activities needs to be organized. This ideal should be inculcated in every pupil, because without systematic order much loss of shop time results. All tools and nonexpendable materials should be marked with a specially selected color to prevent interchange with the equipment from other shops and also as a sign of identification in case of loss. The tools and materials may be taken care of in different ways. One method is to have tools and materials on a panel which has a silhouette of the tool or supply painted on it in contrasting color. This makes checking very easy and losses may easily be discovered. This also is a great aid in self-instruction, as it helps the students to become familiar with shop equipment. Where the toolroom method is not suitable, cabinets or steel lockers located in various parts of the shop may be used for the equipment. The emergency and reserve stock of materials and tools should be kept under lock and key so that students have no access to them.

Students should be held responsible for the checking of tools and materials at the beginning and close of each shop period. It is at this checking period, when the time, trouble, and energy expended in locating and labeling a place for everything is rewarded. Without a definite place for the equipment, neither teacher, nor boy, can make an accurate check-up. The responsibilities of checking the different parts of the shop should be divided among the students and these jobs should rotate, getting a partially new group at these tasks at the close of each week. For example, two boys are given the responsibility of checking up on the shelves or the cabinet containing the finishing supplies. One is the head checker, the other his assistant. At the close of the week the head checker is relieved and the assistant becomes head checker and is given a new assistant. This always leaves one boy who is acquainted with his duties on the job, and also takes care of checking in case of absence of one or the other boy.

At the beginning of the semester a representative job in each trade group should be demonstrated; that is, if there are four groups, four jobs should be demonstrated. The make-up of the sheets should be discussed as to the reason for doing the job, the mate-

rials and tools needed, the procedure, questions, references, suggested jobs to follow, and how the record it to be filled in. The lectures, lecture discussions, and demonstrations may be made most attractive, interesting, and effective by making use of instructional panels such as are illustrated.

The panels illustrated were made by pupils in a 7A home-mechanics class. The plan of putting students work on panels to be used as illustrative material is recommended. Only *honor work* will, of course, be given a place and this inducement may be used as an incentive to do better work. Where the teacher's work is exhibited, as such, it should be done to illustrate the standard which should be striven for by the boy.

Wall charts issued by various manufacturing companies should be available and displayed, such as rip and crosscut charts by the Disston people, the Stanley charts on the names, uses, sizes, and application of tools and joints, Irwin auger-bit display, the File chart by Disston company, and the posters and supplementary sheets issued by INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

These panels and charts should be referred to continually so that the student may familiarize himself with new tools, materials, and processes used, as well as to be reminded of the necessity to observe all safety regulations.

There should be a shop library consisting of tool and material catalogs, and books on the maintenance and repair of the home.

The boy works on his job using the sheets as a guide in the selection of materials and tools to be used and the procedure to be followed in doing the work. Points liable to give trouble in performing the work are cleared up by reference to the job sheet. Individual instruction is given where needed. Before attempting to do a job, the boy should be required to read carefully the entire sheet including the questions and the references. After the job is completed, all questions should be answered on the sheet or in a notebook required for that purpose. While doing a job, the boy meets difficulties which should be jotted down on what is called a "hazy list." These points may be cleared up individually by the teacher or during class discussion.

The proper appraising of the student's work and making a record is one of the difficulties of teaching home mechanics. A satisfactory plan is to appoint a checker in each trade group; that is, one for woodwork, one for bench metal, and so on. Each boy upon completing a job submits his sheet to the checker in the trade group with which he is working. After receiving an O.K. from the checker, the boy submits his sheet to the teacher who looks the sheet over and gives the boy an oral quiz. This is done to satisfy the teacher that the boy has not merely copied his answers from a boy who has previously done the job, and that he actually knows the related information concerned with doing the job.

A convenient method for recording the jobs that have been completed is shown in the chart in Figure 5. The jobs to be done are listed in trade groups across the top of the chart. The name of the pupils are listed at the left. A line is drawn diagonally across the square from the upper right to the lower left when the job is started. This line crossing the first and slanting the opposite way shows that the job has been finished. This progress chart is posted on the bulletin board where all pupils may refer to it. Grades also are recorded on this chart.

Boys are encouraged to do jobs at home and to bring jobs from home to be done in class. Jobs of this kind are given preference over all other jobs, for in them the application of all the work taught in the school-shop is made. Credit is given on jobs done at home, upon proper written evidence signed by a parent.

Since pupils are working in several trade groups at

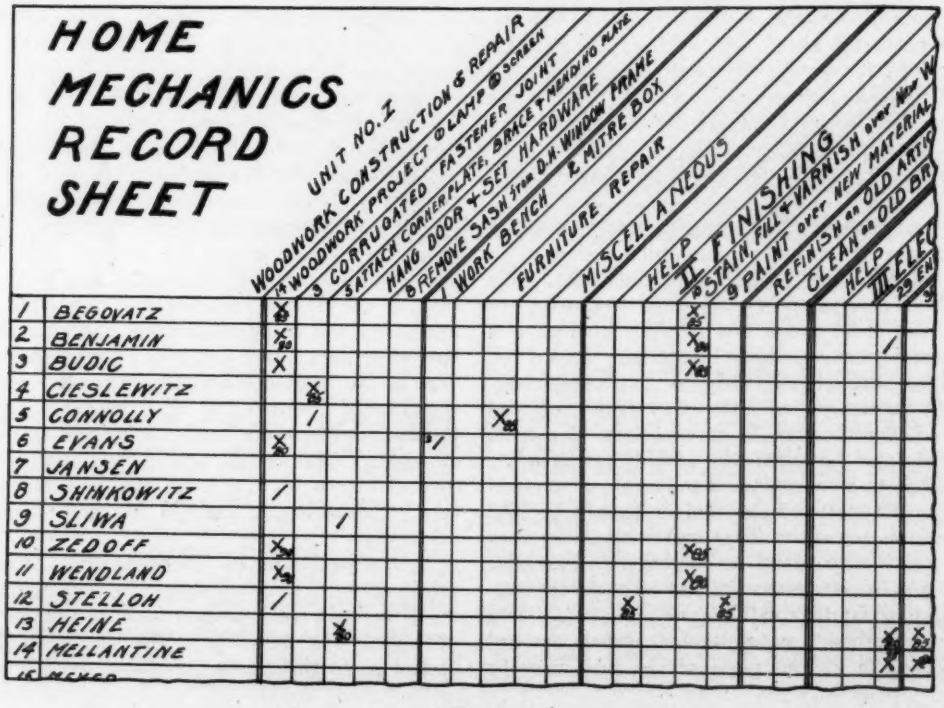

FIG. 5

Name W. Welland
Section 7A$_2$
Group 4 Period
Lockers 1-28

Course 7A Home Mech.

Unit Time	3,5 R	1,2,4,7,8 E	1,4 R	13,15 E	10,34 R	9 E	29,30,31 R	28,32 E	33,35,36 R	37 E	11,12 R	20,21,22 E	16,17,19 R	18,23 E	24,25,26,27 R	E	Remarks
Feb. 4-15	1		8		7		6		5		4		3		2		
Feb. 18-Mar 1	2		1		8		7		6		5		4		3		
Mar. 4-Mar 15	3		2		1		8		7		6		5		4		
Mar. 18-Apr. 5	4		3		2		1		8		7		6		5		
Apr. 8-Apr. 19	5		4		3		2		1		8		7		6		
Apr. 21-May 3	6		5		4		3		2		1		8		7		
May 6-May 17	7		6		5		4		3		2		1		8		
May 20-May 31	8		7		6		5		4		3		2		1		
June 3-June 10																	

Group	
- 1	John Jones, Emil Horvath, Joe Bow, A. Peterson
- 2	F. Bourn, H. Wendt, L. Krebs, H. Rodke.
- 3	L. Cote, A. Inman, E. Haase, J. Sunderson.
- 4	P. Erickson, C. Schmidt, A. Brown, H. Smith.
- 5	P. Lamp, J. Prince, E. Koenes, J. Babick
- 6	G. Washington, F. Falk, S. Dodge, F. Christy
- 7	H. Hepp, L. Gromocki, K. Oberlander,
- 8	M. Panenka, J. Haggarty, Q. Ross, N. Slosser.

FIG. 6

the same time, some organized plan for shifting boys from one group to the other is required. The accompanying chart, shown in Figure 6 shows a plan which has been found very satisfactory not only in home mechanics, but in general metal as well. The left-hand column lists the time divisions. Below the dates are the names of the students belonging to each group. The numbers opposite the dates and under the jobs show just when each group is to start on the work.

The assigning of school marks in home mechanics is based on the quality of work, and the number of jobs completed in any marking period, and what the boy knows about the related information. The outcomes here are in terms of ability to do the work, the knowledge concerning the job and the trade group he worked in, and the desirable attitudes set up relative to doing repair jobs about the home.

There are particular difficulties encountered in determining the school mark in this work. The very good objective method of grading all of the projects of the class at one time on a five or seven point scale of quality is an impossibility in the ordinary home-mechanics class, because the boys have the same contacts only at the end of the course and there are usually three to five marking periods in the semester. Then, too, it is quite possible in a free elective system of selecting jobs to be done, for boys to go through the entire course without having more than two or three jobs in common. The task then resolves itself into appraising the work of each boy, as he finishes his work, with a standard set-up by the teacher, which recognizes the individual ability of the pupil who has done the work. Besides this, his actual knowledge of the work should be tested by objective methods if possible. While the actual jobs in any trade group done by different boys may differ, the tools, materials, processes, and related information is common to all. The objective paper test, therefore, used to discover the boy's knowledge of the work, is a second factor in determining monthly grades. The final mark is based on the monthly averages and the final objective examination.

Samples of questions included in a home-mechanics final examination, illustrate the various types of questions used and suggest the possibilities for testing knowledge of names, care, use, and adjustment of tools; kinds, qualities, sizes, and use of materials; and correct procedures, processes, and constructions. The questions which follow, are taken from a final semester examination and illustrate the various type of questions which may be used in both the monthly and final tests.

The teacher should keep careful check on both the equipment and supplies in the shop, since there are so many kinds of equipment and supplies needed to carry on the work. A "want list" should be kept where the teacher and the shop assistant jot down the materials which should go into the next requisition to the purchasing officer. A list of materials drawn from the shop should be recorded so they may be charged to the proper individuals, and a collection report should be turned in showing the amount of money collected from each boy.

Summary

The teaching of home mechanics presents the difficulties of the general shop, and they may be overcome by carefully considering the purposes of the work, properly selecting and organizing the content best suited to the local community. Effective class organization and delegating of routine work to students is an important factor in securing good results. Careful planning so that the demonstrations and lectures are given at the proper time, and the use of teaching aids and records facilitate the work so that best results are obtained by the teacher. Good results are gotten only by careful preparation for each class.

HOME-MECHANICS EXAMINATION

Name .....Section .....Score .....

Teachers Name .....Semester .....Date.....

TEST A

Directions: Below you will find a number of statements, some of them are true and some are false. In each case make a circle around the Capital T if you think the statement is true and make a circle around the F if you think the statement is false. *Do not guess*; each incorrectly marked statement counts against you.

1. It is necessary to remove the faucet from the pipe in order to rewasher a compression faucet T F
2. A number 7 screw is larger in diameter than a number 9 ..... T F
3. Wards are put in locks to prevent the use of all other than the right key..... T F
4. To reinforce concrete means to add more cement ..... T F
5. A copper wire makes a good fuse link..... T F
6. In soldering utensils, it is necessary to get all parts to be soldered clean and free from dirt.. T F

TEST B

Directions: Each blank indicates a missing word. Fill in the blanks with the word that makes the sentence true. If you finish before time is up, go back and make sure your answers are correct.

1. Before drilling a hole in iron we start the hole with a _____ _____.
2. A ferrule keeps a handle from _____.
3. Lumber that costs $150 per M (thousand feet) cost _____ per foot.
4. Before applying paint it should be thoroughly _____.
5. When we disconnect the gas stove we put a _____ on the end of the pipe to prevent the gas from escaping.
6. When the clapper spring is in contact with the breaker point the coils of a bell or buzzer serve as a _____.

TEST C

Directions: There are a number of incomplete statements given below. After each statement there are a number of words or sentences, one of which in each case will make the statement true. Draw a line under the words or sentences which make the statement true, and put its number on the blank at the right of each statement.

1. To bore a ¾-inch hole use an auger with the following number stamped on the bit, (*a*) 3, (*b*) 4, (*c*) 9, (*d*) 12..... ——
2. A saw marked with a number 7 on the heel of the blade means: (*a*) there are 7 teeth to the inch, (*b*) 7 points to the inch, (*c*) the saw weighs 7 ounces, (*d*) 7 is the makers trade number..... ——
3. Clean shellac brushes and thin shellac with: (*a*) distilled water, (*b*) gasoline, (*c*) alcohol, (*d*) turpentine ..... ——
4. To smooth a first or second coat of varnish use sandpaper number (*a*) 00, (*b*) 1½, (*c*) 2, (*d*) ½ ——
5. A pattern by which sheet metal is cut is called a (*a*) form, (*b*) template, (*c*) measure, (*d*) blue print ..... ——
6. To make a hole in iron we use (*a*) an auger bit, (*b*) gimlet, (*c*) twist drill, (*d*) counter sink..... ——

TEST D

Directions: Below you will find a list of tools numbered and also a list of jobs. Each tool is to be used in performing one special job. Place on the blank opposite each job the number of the tool used in that job. Number one is correctly filled out.

Tools to be used	*Jobs to be done*	*Number of tool used on this job*
1. Emery wheel	To cut ¼-in. round iron to lengths	4
2. Plumbers friend	To grind a badly nicked plane bit	——
3. Rip saw	To locate a blown fuse	——
4. Hack saw	To whet a chisel	——
5. Burring reamer	To thread a pipe	——
6. Automatic drill	To cut a board with the grain	——
7. Stock and die	To open a clogged sink trap	——
8. Fine oilstone	To make a pilot hole in wood	——
9. Test lamp	To remove the rough edge on the inside of a pipe after cutting	——
10. Counter sink		
11. Pipe cutter		

TEST E

Directions: Below you will find a list of materials to be used in performing certain jobs. In the third column place the number of the material to be used in the job listed opposite. No. 1 is correctly filled out.

Materials to be used	*Job to be done*	*No.*
1. Flexible cord	To fix a leaky compression faucet	3
2. Asbestos heater cord	To wire a door-bell circuit	——
3. Round rubber washer	To make an extension cord for a lamp	——
4. Annunciator wire	To make an extension for a flatiron	——
5. Shellac or varnish	To make the blade of a screw driver	——
6. Ferrule	To fill closed grained wood	——
7. ¼-in. drill rod	To sharpen a lawn mower	——
8. Emery dust and oil	To make a screw-driver or garden-trowel handle	——
9. Fuse links		
10. Varnish remover		

The Relation of Industrial Arts to Vocational Education

*Laurence Parker**

EVERY once in awhile it is profitable to consider once more the important relationship existing between industrial-arts and vocational education.

For the purposes of this discussion we shall think of industrial arts as being for the following purposes:

1. Trade exploration.
2. Appreciation of craftsmanship and being a good consumer.
3. An aid to resourceful constructive thinking.
4. Developing coördination between hands and brains.
5. Development of work habits.

Vocational education we shall define as the training of a person to make his living at an occupation which he has decided upon.

If you will, for the time being at least, accept these definitions, as briefly stated, you will readily see that there is no competition or overlap between them. I see none and never hope to see any competition or rivalry between them. Each has its place in the scheme of an individual's life and an important place, too.

Charles R. Allen at a vocational conference at Blue Ridge, North Carolina, some years ago, gave a very interesting talk on vocational guidance. One of the points he made was this: "The boy of 13 is not the same individual at all that later becomes 16 or 18 years of age." If we accept this statement of Dr. Allen's, we can say that ordinarily the industrial-arts work is for an entirely different individual than the one who takes vocational education at a later time in his life.

He has changed rapidly and rather completely during junior-high-school years.

At one time in my boyhood I wanted to be a helper around a racing stable. What could be more noble than to develop race horses. Some time later I suggested to father that we buy a merry-go-round, father to run it; mother to sell the tickets. Can you guess what I had picked out to do? Most grown-ups, in their younger years have picked out occupations which attracted for the moment. They were sure they knew what they wanted to do, but the next week or next month it was something else.

So we need in those younger years trade exploratory courses, many of them, many more than we have today and each presenting as complete and accurate an experience as possible of the occupation represented. We are expecting industrial arts to do this for the adolescent. Many of us would have benefited tremendously and saved time in getting on an earning basis if we could have in our younger days explored more occupations than we did. Remember also, the better the exploratory course, the nearer it comes to being actual training in the trade it explores.

Advertising has become as deadly a weapon as the sawed-off shot gun. You turn the pages of a magazine; the *Saturday Evening Post* is an exceptionally good example. You stop at a page displaying a "rest-some-more" mattress, a radio, or a heating plant where the family dog acts as fireman. You stop, you look, and you read. Something clicks inside of you, and the reason for the click is that both barrels of that advertising sawed-off shot gun got you. You *must* have the article. In these days of high-powered advertising, we need to have an appreciation of craftsmanship in order to be an intelligent consumer. We need to see at a glance that the proportions of the lowboy radio cabinet as displayed are pleasing or that they are bad. We need to know the difference between "solid oak" and "quartered oak" in the furniture displayed. In shorter words, we need that sixth sense developed that instinctively brands a job as a good one or a bad one. This we are hoping industrial arts will develop in our boys long before they make up their minds as to their occupations.

Time and again we hear the claim made, "The American people are not a thinking people. They are ruled by their emotions." We know from experience and observation that more constructive thinking will make our heads save our heels. Everyone of us needs to do more solid, constructive thinking. To our aid and encouragement, Thorndyke steps forward and says, "Industrial arts is as efficient in developing constructive thinking as are plain and solid geometry." Dr. Prosser calls it resourceful constructive thinking. So we can hope that more and more there may be a realization of this possibility as the result of industrial-arts courses.

It used to be the fashion for the professional man and the business man to brag about their helplessness when facing mechanical troubles. Most of them could grease a buggy and that was about all. They might have to experiment as to which way to loosen the nut. A doctor was called to our house one time to remove a chicken bone stuck in mother's throat. He needed to use his little searchlight but it wouldn't light. He was helpless without the light. Mother was helpless until he could use his light. If he had taken some electrical work in an industrial-arts course, when a boy, he could have done what I had to do for him.

The advent of the automobile with its long and strenuous course of "get out and get under" in its early years has changed all that. Our homes, too, have become veritable factories with all the machinery we are now buying on conveniently spaced payments. Someone must service the sweeper, the electric refrigerator, the ironer, the toaster, the washing machine, lawn mower, fan, and the radio. If our sons can learn to be home engineers and handy men of this sort, real savings on service charges will result which can be applied on the payments, otherwise we may miss a

*Kansas State Teachers College, Pittsburg, Kansas. From a paper presented by the author at the meeting of Kansas Industrial-Arts and Vocational Association, Wichita, Kansas, October 30, 1929.

payment or two and lose some of the conveniences. We are hoping, therefore, that industrial-arts courses will effect coördination of hand and eye, but we also hope that they will, as a by-product, make handy men of our boys.

It is my pleasure to visit a number of high-school auto-repair shops. The way that the boys go at their work differs greatly in the different shops. One which recruits boys from the country, is a marked contrast to the others. In this shop the boys move briskly, tackle a job as though they mean business, and clean up a job as they go. Why is it? They learned the habit of work on the farm and their instructor sees to it that they don't forget the habit. We are looking to industrial-arts courses to develop the habit of work in the modern youth who is not compelled to work at home. This is no easy task.

Vocational education is entered upon when this boy, or girl, has at last decided upon the career he wants. It may be the law, medicine, journalism, salesmanship, plumbing, radio servicing, short-order cooking, telephone installing or any other of the more than two thousand recognized occupations.

Once decided upon and training commenced, the work in industrial arts commences to pay dividends. If the trade exploratory courses were thorough, the boy does not quit the plumbing trade in disgust after wasting six months at it. The boy goes into the trade, as we say, with his eyes wide open to the advantages and drawbacks in the trade work.

If that sixth sense of when a job is a good one has been developed, by industrial-arts courses, he will know when a job is a good one and he will be less likely to be satisfied with a poor job. This is a highly important thing in the training of a surgeon, a pattern-maker, a dentist, or any other of our two thousand occupations.

The advantages of resourceful constructive thinking are too obvious to mention. It is the ability we all covet in connection with our vocations.

He will carry over from industrial arts the work habit. That is one form of "carry over" that we will all agree is possible and highly desirable, whether he is in training as a lawyer, a journalist, a machinist, or a bookkeeper.

And so the relationship between industrial arts and vocational education is a close one and a helpful one. The better that industrial arts accomplishes its aims as outlined above, the better chance the boy has in his vocational training.

A man and his wife get along very well usually when the man keeps his fingers out of the housekeeping and the wife minds her own business. As long as those intrusted with the industrial-arts courses continue to follow their aims and objectives and the vocational educator his, there should not only be peace and harmony between them, but a chance for sympathetic and helpful coöperation.

The topic suggests that there may not be harmony between these two groups. I hasten to say that there is harmony and coöperation between the industrial-arts men and the vocational men. Each knows his part in the scheme of things, but it pays at times to consider the importance of the relationship.

Educational and Vocational Guidance in Junior High Schools

*Harold D. Grubs**

BEFORE discussing the problem of educational and vocational guidance for junior high schools, it is necessary to first get a clear understanding of the meaning of the terms "educational guidance," and "vocational guidance."

Educational guidance is conscious effort to assist in the intellectual growth of an individual. Most educational guidance is also vocational guidance. The chief educational guidance needed at the present time, and the best way in which it can serve the child in actually selecting a vocation, is to give advice which improves his choice of school courses.

Vocational guidance is concerned with helping persons choose, prepare for, enter into, and make progress in definite occupations. How easily and how interesting all these subjects could be made if they could be more closely correlated.

The aims of educational guidance from the viewpoint of all guidance are as follows:

1. To study each child as a separate problem. To this end, a very comprehensive data card should be kept of each pupil, which should contain all the information it is possible to obtain regarding the history of the boy and of his family. A careful grading and evaluating system should be kept so that the line of work in which the student is interested may become apparent, and he may be more readily advised as to which courses will prove most profitable to him.

2. To make the school organization flexible and to make it possible for the teacher to play the part of a counselor.

3. To make the vocational possibilities of the school program function, and to add to the program an effective course in occupations.

4. To encourage and direct such student and club activities as will contribute to the finding of interests and vocational clews.

5. To use the prevocational and continuation school for self-discovery, conservation, and reclamation.

6. To provide schools of secondary and college grade for the definite preparation for the occupation.

7. To develop good traits of character and the formation of good habits.

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The junior high school has been termed the boiling point of guidance. If there is a time in a child's life when guidance is needed more than at any other, it is during the junior-high-school period. Wise guidance will steer many a child past the rocks and whirlpools of the adolescent age. Many pupils in this stage or period have reached the limit of their ability in academic subjects. Others are undergoing such unusual physical growth and development that their mental growth seems almost at a standstill, but with careful guidance their mentality will later grow and develop remarkably. Counseling is needed on every hand in junior high schools.

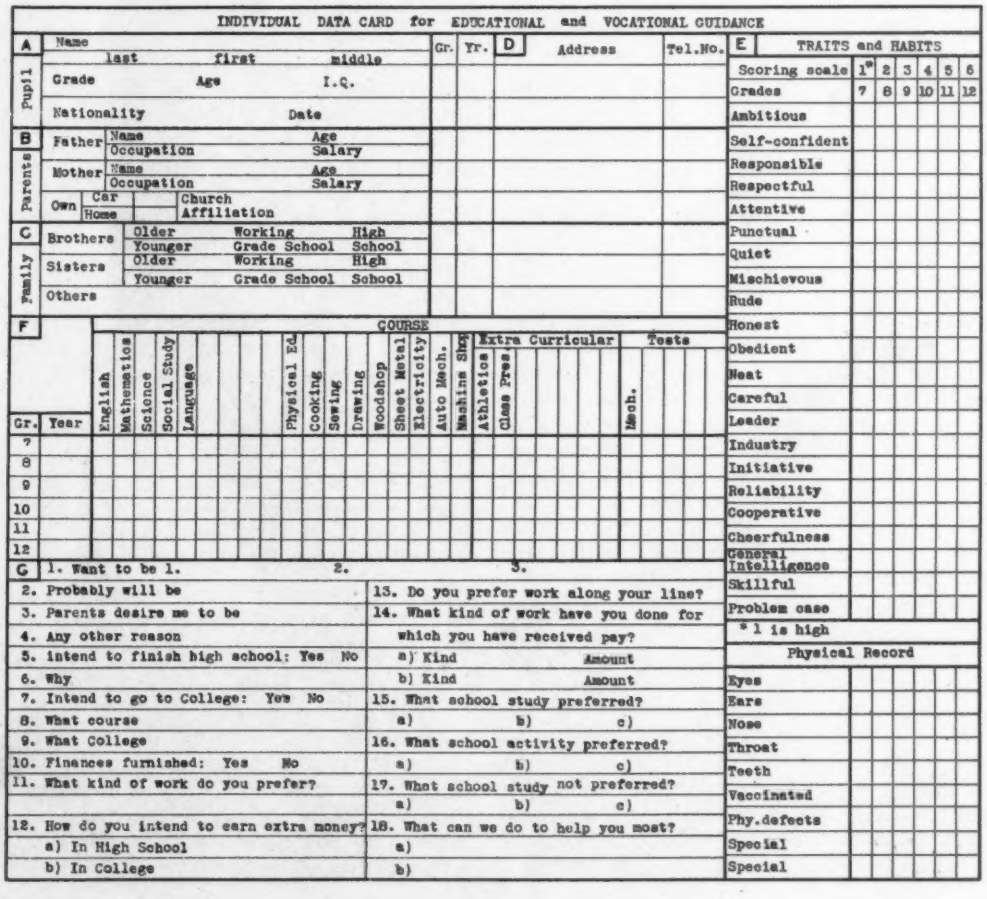
The following groups of pupils need expert counsel:

1. The pupil uncertain about his choice of selections.
2. The prospective drop-out.
3. The pupil who is failing in one or more subjects.
4. The pupil in need of financial assistance.
5. The socially maladjusted pupil. Some of this counseling may be done in groups, but personal interviews by trained counselors are essential in most cases.

The rapid growth of intermediate and junior high schools represents a serious attempt to help all pupils, regardless of their social status or lifework, to meet new and changing demands for many-sided service as members of families, and of vocational and civic groups. One of the outstanding features of any statement of the aims and purposes of the junior high school is that it proposes to retain a larger proportion of its student body than has heretofore been considered possible. It proposes to do this by the recognition of individual differences, and by the making of distinctive offerings and adjustments in its courses of study, so that these individual differences can be best accommodated.

We find also that the junior high school is one which is supposed to offer diversified experiences for self-discovery, for the discovery of aptitudes and abilities, and for explorations in a variety of fields. This particular type of school also claims that its curricula are organized on the basis of the recognition of the fact that a large proportion of its students are adolescents. All of this means guidance, not only educational and vocational, but also physical, civic, social, and moral guidance. In fact, the curricula and all the extra classroom activities should be regarded as little more than guidance at its widest aspect.

A well-organized junior high school should, to fulfill the special purpose of such a school, have at least four curricula offerings; first, the straight academic course; second, the household-arts course; third, the industrial-arts course; and fourth, the commercial-arts course. These should not be strictly prescribed courses, but should be made up of required subjects called "constants," and with electives or variables. The selection of these courses with their variable electives constitutes a real guidance problem. In addition there is the wide range of extra-classroom activities which are a vital part of every well-organized junior high school. The process of elimination becomes



INDIVIDUAL DATA CARD for EDUCATIONAL and VOCATIONAL GUIDANCE

A Pupil: Name (last, first, middle); Gr.; Yr.; D Address; Tel.No.
Grade; Age; I.Q.
Nationality; Date
B Parents: Father Name; Age; Occupation; Salary
Mother Name; Age; Occupation; Salary
Own Car / Home; Church Affiliation
C Family: Brothers — Older / Younger; Working / Grade School; High School
Sisters — Older / Younger; Working / Grade School; High School
Others

F COURSE — Gr. / Year; English; Mathematics; Science; Social Study; Language; Physical Ed.; Cooking; Sewing; Drawing; Woodshop; Sheet Metal; Electricity; Auto Mech.; Machine Shop; Extra Curricular: Athletics; Class Pres.; Tests: Mech.
7
8
9
10
11
12

G
1. Want to be 1. 2. 3.
2. Probably will be
3. Parents desire me to be
4. Any other reason
5. Intend to finish high school: Yes No
6. Why
7. Intend to go to College: Yes No
8. What course
9. What College
10. Finances furnished: Yes No
11. What kind of work do you prefer?
12. How do you intend to earn extra money?
a) In High School
b) In College
13. Do you prefer work along your line?
14. What kind of work have you done for which you have received pay?
a) Kind Amount
b) Kind Amount
15. What school study preferred? a) b) c)
16. What school activity preferred? a) b) c)
17. What school study not preferred? a) b) c)
18. What can we do to help you most?
a)
b)

E TRAITS and HABITS

Scoring scale	1*	2	3	4	5	6
Grades	7	8	9	10	11	12
Ambitious						
Self-confident						
Responsible						
Respectful						
Attentive						
Punctual						
Quiet						
Mischievous						
Rude						
Honest						
Obedient						
Neat						
Careful						
Leader						
Industry						
Initiative						
Reliability						
Cooperative						
Cheerfulness						
General Intelligence						
Skillful						
Problem case						

* 1 is high

Physical Record

Eyes						
Ears						
Nose						
Throat						
Teeth						
Vaccinated						
Phy.defects						
Special						
Special						

quite noticeable in the junior high school and becomes a serious problem in the senior high school.

It is a well-known fact that a large number of both junior- and senior-high-school students are employed at some form of remunerative employment solely for its financial rewards, which usually has little tryout or educational value. It is quite certain that if the director of guidance should arrange and classify the opportunities for this type of employment, many positions of decided tryout value would be developed. To accomplish this, it is his duty to make all possible contacts with industry. A thoroughgoing analysis and diagnosis of each student should be made a part of the guidance system of any junior high school. A complete, accurate, and detailed record of all phases of the student's life, so far as it is obtainable, should be kept throughout the junior-high-school period. A date card for such purposes is the basis on which this article is written. Various tests should be given, recorded, and the results interpreted, and finally used as a basis for advice and guidance. This is the diagnosis side of guidance.

Let us now consider the industrial-arts courses in the junior high school as tryout courses. Much has been said and written concerning the great value of the so-called tryout courses in the junior high school, and the statements have generally been accepted at their face value. This situation is unfortunate, because it is quite well known that the limited offerings of practical work in the laboratories of the junior high school do not in themselves constitute real tryout courses. They are merely limited attempts in this direction. It is not my purpose, however, to deprecate the value or the advisability of having shopwork in the junior high school. We need more of it, with better organization and better teaching.

The tryout courses, the general shop, or laboratory, and the organized activities of the junior high school afford many opportunities to the pupil to acquaint himself with some of the underlying principles of a few different occupations. Even if he makes no choice, or if his choice is changed later, he is obtaining valuable information about different occupations which will be useful when he does make his choice. There is at least a negative if not a positive value to the courses in the industrial-arts department. The pupil can decide that he does not care for certain trades, even though he does not discover the one which he wishes to choose for his life's work. Alice Barrows, of New York City, says, "Vocational guidance should mean guidance for training and not guidance for jobs." Allen, of Providence, Rhode Island, says, "You cannot make the most of the child vocationally unless you have made the most of him educationally."

Last, but not least in importance, comes the personality of the guidance counselor. In the majority of junior high schools the administrators seem to feel that they have fulfilled their functions in regard to vocational information if they set aside one or two periods of 45 minutes each week for a class in occupations, usually taught by the teacher of English or civics. This teacher quite generally knows very little about the occupations, the conditions of work and service, and the requirements for entrance and progress in either business of industry. At any rate, the classroom teacher is the key person in any effort to organize a guidance program for any unit of the public-school system. Whether the guidance function is performed by a classroom teacher or by a special counselor giving part time or full time to the task, there are certain duties or services which must be performed to the best of the counselor's ability. These duties may be classified under the following headings: first, discovery of abilities of school children; second, adjustment of school tasks to needs and abilities of the individual child; third, coördination of school activities with the aims of guidance; fourth, the giving of counsel relating to the selection of, and preparation for a life career; fifth, the keeping of a usable system of records; and sixth, the organization and carrying out of an adequate guidance program.

In considering the personal characteristics and qualifications desirable in school counselors and directors of advisement, at least three important characteristics should be mentioned: First, social characteristics. It is the sympathetic, tactful type of person with the capacity for insight into the possibilities of boys and girls, and the ability to inspire them to the kind of effort necessary to measure up to their true endowment, who makes the most desirable counselor. As Herbert Hoover says, "It is the function of the counselor to discover talent, to create character in the child possessing that talent, and to inspire that child in such a way that he will make the necessary effort to realize his life dreams and aspirations." Second, the education of the counselor should be considered. The classroom teacher should have had in the normal school a course in principles of educational and vocational guidance, as well as a course in educational tests and measurements. A full- or part-time counselor in the junior high school should at least have an A.B. degree, and should have had courses in economics, sociology, psychology and education in addition to the courses in guidance and measurements. Third, the experience of the counselor should be carefully considered. The guidance counselor should have had a sufficient experience of life to give him practical judgment, or what is ordinarily called "common sense." Summer vocational experiences in a variety of occupations will give a better insight into the advantages and disadvantages of those occupations than any amount of studying would give.

The administrator of a junior high school who will organize a complete system of guidance on a scientific basis and allow it to function to the fullest extent, will make a professional reputation for himself that will be the envy of his colleagues and will render the greatest service to the pupils of his school.

INDIVIDUAL NEEDS

It is one thing to decide what kind of education an individual pupil needs in order to "round him out," to make a "well-educated man" out of him. But we must realize that education is largely a process of "fitting in," of molding the individual to fit somewhere in the social framework. It is as necessary, therefore, to study that into which the individual is to be fitted as it is to study the individual himself. — *Thomas Nixon Carver.*

Does General Mechanical Aptitude Exist?

*Harry Dexter Kitson**

ONE of the concepts frequently associated with vocational guidance and vocational selection is mechanical aptitude. Certain individuals seem to adapt themselves readily to occupational activities requiring mechanical manipulation while others find difficulty in making such adaptations. The explanation is usually offered that there must be some mysterious thing called *mechanical aptitude* which some people have and others do not.

This explanation seems to be so attractive from a logical point of view that it has gained many adherents. The popular literature on vocational guidance reflects it; several psychologists have devised tests designed to detect and measure mechanical aptitude; and many school administrators use these tests for directing pupils into or away from training courses of a mechanical nature.

In spite of the seeming logical cogency of this view, it has never justified itself on psychological grounds, and when we review the situation we can see little basis for believing that it can ever do so.

Before proceeding with our discussion we ought to make a distinction in the interest of clearness between the commonly used terms, ability and aptitude, which are used interchangeably, but which should not be. Ability is a thing acquired; aptitude is the capacity for acquiring. It is the latter we are considering here, since it is the factor most people have in mind when they speak of mechanical aptitude. It should be remarked that most persons think of this aptitude as being innate.

In beginning our inquiry, we should note an important dictum of scientific method known as the *Law of Parsimony*. This runs as follows: "No explanation should be accepted concerning any phenomenon until all other sources of explanation have failed." In trying to account for the ease or difficulty of making mechanical adaptations, we should use this principle and, until we have exhausted all other resources, we should refuse to accept the easy explanation that there is an entity called mechanical aptitude.

Now we can suggest a number of explanations besides that of a general mechanical aptitude. In the first place, the skill with which a boy of 14 may deal with mechanical things may be a result of early experiences which have predisposed him toward such manipulations. In view of recent disclosures showing the lasting influence that may be exerted by infantile experiences, we should be quite ready to admit that experiences even during the first six months might give a child an emotional set toward digital manipulation. And conversely, certain unpleasant experiences at an early age might give a child a negative emotional attitude toward such manipulation, all apart from any innate capacity.

Another explanation dictated by common sense is that the reason some adults do not readily perform mechanical feats is that during their youth they never had opportunity or stimulation to do so. They were, perhaps, unusually bright in academic work and so were encouraged to spend their major time and efforts in abstract thinking. Later they got into a profession where they had to spend their time in abstract thinking, and so they never developed habits of mechanical manipulation though they could easily have done so if they had taken the time from intellectual pursuits.

Probably one of the most damaging things we can say about the theory that mechanical aptitude exists is that it is a survival of the old faculty psychology of an earlier generation. It presupposes a mechanical faculty on a par with the old faculties of number sense, language sense, form sense and the like, into which the mind was divided by the phrenologists. Such faculties were discredited by psychologists a number of years ago, and the arguments formulated against them apply with equal force to the newly created faculty of mechanical aptitude.

One of the things that makes mechanical aptitude difficult to accept is the inconceivability of any general aptitude that might underlie the diverse adjustments of a mechanical nature which human beings make. For instance, repairing an automobile, repairing a harness, running a sewing machine, repairing a watch, etc., all present many differences. They involve no single muscle or set of muscles, but the coördination of many. Some of them involve movements of the gross organs of the body such as the arms and legs, while others require the most delicate movements of finer muscles in the fingers and even the eyes. Some of the skills may involve tonicity of muscles, some, elasticity of tendons. Others may be due to readiness of discharge over the motor tracts leading from the top of the brain. Still others may depend on perfect articulation of the joints. Some manual dexterities might even be due to length of fingers. Above all these is general intelligence which is an important component. In view of such diversity of ingredients it is difficult to conceive of any unitary capacity with a physiological basis (which all capacities must have) that could underlie them all.

The believers in mechanical aptitude seem to think of it as a general capacity analogous to general intelligence. Indeed, some of them call it *mechanical intelligence*. Now while we can conceive of intelligence (commonly defined as the general capacity consciously to adjust one's thinking to new conditions) as having a physical basis — namely, the degree of impressibility, conductivity, and retentivity of the cells composing the nervous system — we can hardly conceive of any analogous physical basis underlying the diverse adjustments which are called mechanical aptitude.

Passing from these considerations, let us examine the objective means that have been employed to isolate this alleged entity and subject it to measurement. These are the so-called tests of mechanical aptitude.

Before proceeding to treat them in detail, let us review briefly the steps usually taken in trying to

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devise a test for mechanical aptitude. It is a fundamental principle that before a test can be called a test of mechanical aptitude, it must be *proved* to be so. Merely to invent a test and *call* it a test for mechanical aptitude does not make it so. How difficult it is to obtain the necessary proof, we shall point out presently. For the present we shall content ourselves with describing the process usually employed in seeking it: Select a trial group of persons of the kind for which the test is being devised and rank them according to the degree to which they possess mechanical aptitude. The basis on which they are ranked is called the *criterion*. Give them the test that is being tried out. Then find the degree of correspondence between (1) the standings of a large number of these persons in mechanical aptitude (according to the criterion) and (2) their standings in the test. If there is a very close agreement, it is generally assumed that the test measures the mechanical aptitude sought. If it is not close, the test does not measure it.

The tests that have been most prominently brought before the attention of the public are those of MacQuarrie[1] and Stenquist.[2] The latter test now has three forms: (1) Assembly Test; (2) Paper and Pencil Test; (3) The Minnesota Revision[3] of the Stenquist Assembly Test which has recently been made at the University of Minnesota. We shall consider these tests in the light of their adherence to the requirements of scientific method as outlined above.

Criterion. Let us first ask what criteria these investigators used as indices of mechanical aptitude. It is obvious that this aptitude, if it exists at all, is something that cannot be touched and handled. All one can ever get is some expression of it; such as skill with tools or quantity or quality of output in occupations that are unmistakably mechanical, etc. MacQuarrie used output graded as to quantity and quality. Stenquist used estimates made by teachers in manual arts and shopwork in the public schools.

As to the value of such estimates, no one knows. Estimates made by individuals are notoriously unreliable. Figures are not available showing the unreliability of the criterion used by Stenquist or the Minnesota investigators, but MacQuarrie took the precaution of comparing the ratings on mechanical aptitude made by one teacher with the ratings made by another, and reports the low reliability coefficient of .40. This probably means that the teachers used as bases other things than those which judged mechanical aptitude. They probably graded on such things as attentiveness, obedience, manifestation of interest; in short, the criterion was academic, not vocational. The value of tests standardized on such a criterion is negligible, for *a test is no more valuable as index of vocational aptitude than its original criterion is valid.*

Another weakness in the criterion used by these investigators, and also in the criterion used by most investigators of tests for vocational aptitudes, is that they use only boys in school and do not use adult workers of proved vocational proficiency.

Reliability of the test. One important requirement that must be met by a test is that it should have a high degree of reliability. This reliability may be measured by giving the test twice to the same group, or by dividing the test into two parts and correlating the standings of the same individuals on these two parts which are, for practical purposes, considered as two separate tests. "The experimenter should have little confidence in the reliability of individual scores unless his test has a self-correlation of .95 or above. . . ."[4]

The reliability of these mechanical tests is reported as follows: Stenquist used a number of groups — boys and girls in elementary school, boys in high school, and men in the army. The reliability coefficients among these various groups range from .06 to .80. The average is only .59. The reliability of the Minnesota Revision of the Stenquist Assembly test is reported as being .94. MacQuarrie reports a reliability coefficient of over .90.

Intercorrelations between various mechanical tests. Some evidence concerning the value of mechanical tests in general may be obtained by computing the correspondence between the standings which persons make on two or more of the tests. Stenquist computed the correlation between two forms of his assembly test, and found a correlation coefficient of only .59. (369 children in seventh and eighth grades.) Between his assembly test and his paper and pencil test, Stenquist gave both these tests to 145 boys aged 12 to 15, and found a correlation coefficient of only .42. Toops also correlated the standings in tests devised by several investigators and found an average intercorrelation of only .40. Board, Marsh, and Stockwell[6] correlated standings made by 500 pupils in junior high schools, in the Stenquist paper test, with standings on the MacQuarrie test and found a correlation coefficient of only .29. All these correlations are low. Surely if these tests are to be regarded as tests of "mechanical aptitude," they should correlate with each other around .80. Since they do not, we can only conclude that they test diverse reactions. As to which one of them really measures *mechanical aptitude,* we do not know. Perhaps none of them do so.

Validity of the tests for mechanical aptitude. As was said in a preceding paragraph, another of the requirements of a test for mechanical aptitude is that the standings made in the test by persons of known mechanical aptitude shall agree with their relative standings with respect to the criterion. Stenquist correlated the standings in shopwork of a number of small groups of schoolboys with their standings in the assembly test and found a correlation on the average of .77. The standings in the paper and pencil test correlated lower (.60) with ranks in shopwork.

MacQuarrie found a correlation between standings in his test and in teachers' ratings of only .48. When he changed his criterion to objective ranking of the products of the boys' output in shop courses, he got

[1]MacQuarrie, T. W., "The MacQuarrie Test for Mechanical Ability," *The Journal of Personnel Research*, Vol. V, pp. 329–337.

[2]Stenquist, John, *Measurements of Mechanical Ability*, Teachers College Contributions to Education, Number 130, 1923.

[3]Anderson, Dewey, "Minnesota Mechanical Assembly Tests," *The Personnel Journal*, Vol. VI, 1928, pp. 473–478.

[4]McCall, W. A., *How to Experiment in Education*, Macmillan, New York, 1926, p. 112.

[5]Toops, Herbert A., *Tests for Vocational Guidance of Children Thirteen to Sixteen*, Columbia University Contributions to Education, Number 136, 1923.

[6]Board, Marsh, Stockwell, "The Relation of General Intelligence to Mechanical Ability," INDUSTRIAL-ARTS MAGAZINE, September, 1927, Vol. XVI, No. 9, pp. 330–332.

in one case a correlation coefficient of .81, but in another case only .32. Which one should we accept?

No figures are available showing the correlation between standings on the Minnesota revision tests and standings on the criterion.

We have now to examine these correlations to see how much validity they denote. They are quite generally accepted as high and are complacently pointed to as evidences that these tests do test and measure *mechanical aptitude*. When we scrutinize them closely, however, we can find no justification for such confidence.

Let us first look at them in the light of what Hull[7] calls their "forecasting efficiency." A coefficient of correlation amounting to .60 indicates, according to Hull's table, a forecasting efficient of only 20 per cent. That is all there is to the Stenquist Assembly test. A coefficient of correlation amounting to .77 (MacQuarrie) means a "forecasting efficiency" of only 35 per cent. Accordingly, we see that when translated in terms of practical usage these tests do not appear as valuable as they are alleged to be.

But apart from these statistical considerations, there are other grounds for hesitating to accept these correlations as proofs that the tests measure the thing they are alleged to measure. These grounds are, that the criteria on which the tests were validated were insecure. As was said, the criterion used by Stenquist was purely the opinion of teachers as expressed in grades in shop courses. Such opinions are notoriously invalid as measures of true aptitude. The mere fact that the teachers failed to agree with respect to the individuals they judged should be sufficient evidence of their undependability. In answer to this objection, the statement is sometimes made that if we had a larger number of judges, we might get a higher correlation. But the answer might be made that if we had a better criterion, we might get a *lower* correlation. As to what should be used as a criterion, we have no suggestion. Surely we should include as one important criterion the *objective output of adult workers in occupations that are unquestionably mechanical*. That Anderson, who worked on the Minnesota Revision of the Stenquist Assembly Test, agrees with this is indicated by the closing sentence of his preliminary report: "It is important that the value of these tests should be determined in actual industrial situations."

Correlation between standings in mechanical tests and standings in intelligence tests. One argument presented in favor of the existence of mechanical aptitude is that the standings in "mechanical" tests correlate low with standings in intelligence tests. Stenquist reports such correlations computed on the scores made on his assembly test by a number of groups. The average of these correlations is .29. He reports correlations between intelligence scores and scores on his picture test ranging from .52 to .64. MacQuarrie reports that the correlations between these two factors was not over .20 in any of the groups he tested, though a class at Columbia University was tested with the MacQuarrie test and the Otis intelligence test, and the correlation coefficient was .57. Board, Marsh, and Stockwell also found low correlation between standings in the Stenquist and MacQuarrie tests and standings on the Terman group test of intelligence. On the basis of these low correlations the claim is made that these mechanical tests do not measure general intelligence but that they test another kind of aptitude — mechanical — which is independent of intelligence.

In appraising the force of this conclusion, we should fix our attention not on the fact that the correlation between mechanical tests and intelligence tests is low, but on the fact that the correlation is *positive*, and indicates some relation between these two capacities. Just because it is low does not mean that the two are unrelated. As a matter of fact, it is no lower than the correlation between two separate components of many of the intelligence tests; such low correlation between parts is often used as an argument for retaining them as components of an intelligence test.

We might also cite this low positive correlation as an argument to support the position that these mechanical tests are merely intelligence tests. Such a conclusion is favored by several facts which will now be recited. First we may call attention to some figures furnished by Stenquist. His assembly test was given to 909 soldiers who had been tested with the Army intelligence test. The correlation between their standings in the intelligence test and their standings in the mechanical test was .51. While this is not high, considered absolutely, it is almost as high as the correlation between the mechanical tests and their criterion (.59). Another sign that makes it seem probable that the mechanical tests are really imperfect intelligence tests, is that Toops found that the Stenquist paper and pencil test correlated with intelligence in the neighborhood of .60, as high a correlation as that between the mechanical test and its criterion.

Other evidence to the effect that mechanical tests measure chiefly intelligence, comes from an investigation made by Keane and O'Connor.[8] They devised a block-assembly test which they call a test for mechanical aptitude. They gave this to four groups of persons — 868 unselected people, 114 mechanics, 81 draftsmen, and 44 engineers. The things we wish to call attention to here is that the engineers, who were college graduates, made higher scores on this test than did the mechanics. The former were more intelligent than the latter — natural selection would have made them so, since they had enough intelligence to pass a four-year college course. Accordingly, we may well conclude that their high standing on this test reflected chiefly their general intelligence. If one retorts that engineers stood higher than the unselected persons who presumably were not very mechanical, we can again point to the fact that engineers are more intelligent than the average of the population. (The Army intelligence tests showed them to be near the top of the list.)

One of the most serious of the faults in current views regarding this matter is the tendency of people to regard intelligence and mechanical aptitude as opposites; to conclude that if a person is of low intelligence he must be highly apt mechanically, and if a person is high in mechanical aptitude he must be low in intelligence. Though Stenquist should not be

[7] Hull, Clark L., *Aptitude Testing*, World Book Company, 1928, pp. 273–275.

[8] Keane and O'Connor, "A Measure of Mechanical Aptitude," *The Personnel Journal*, Vol. VI, 1927, pp. 15–24.

charged with holding this view, he does go so far as to cite individual cases of men who did only mediocre work in abstract school studies, but who made outstanding records in mechanical or semimechanical fields — Napoleon, Fulton, Curie, etc. We might cite just as many men who are both highly intelligent in abstract affairs, and who are at the same time notably efficient mechanically: Benjamin Franklin, Kreisler, Joseph Hofman, etc. Everyone knows certain intellectuals who maintain a shop in their basement where they love to tinker with mechanical things.

But instead of dealing with individual cases, we should investigate many cases. One teacher[9] of shopwork who questioned the common assumption that boys who were high in one of these traits must be low in the other, made an investigation of 210 college freshmen, comparing the scores they made on an intelligence test with the grades they made in shopwork. He found that those who made high grades in shopwork were more intelligent than those who made low grades. (See Table I.)

TABLE I. Intelligence Relation Between Standings in Shopwork and Scores on Intelligence Test

Shopwork Rating	*Intelligence Test Scores*			
	D — E	C+, C, C—	A — B	Totals
A — B	4	11	16	31
C+, C, C—	21	73	26	120
D — E	18	35	6	59
Totals	43	119	48	210

This investigator concludes:

"1. That the chances against a boy rated as inferior in intelligence doing superior shopwork are about ten to one.

2. That nine out of ten boys of below average intelligence receive shop grades of average and below.

3. That of every two bright students, one will do superior shopwork.

4. That in a group of ten boys of 'average' mental capacity, six will do average work in the shop.

5. That the chances against poor shop grades being received by a student of superior mental capacity, are about eight to one; with an inferior student, three to one.

6. But — that 70 per cent, seven out of ten of these dull students received shop grades that were better than 'just passing.' The boy's I.Q. is an excellent indication of the grade he will receive in the shop, but the correlation between these two factors is higher in the groups of high or average intelligence than with the dull group."

The error most people make consists in thinking of the population as being divided into two groups, mechanical and nonmechanical. As a matter of fact, it is not so divided. Even if mechanical aptitude exists, it is distributed among human beings according to the probability curve. At one end of the scale are a few people who are very mechanical, at the other are a few who are not very mechanical, while the *majority of people can do mechanical work to a medium degree.* Now since there is a positive relation between intelligence and mechanical aptitude, it must follow that the two are related, and that the person who is high in the one is likely to be high in the other. While the correlation is not notably high it is positive, and it is probable that the most of the displacements are in the medium ranges and not at the extremes. Surely the fact that the majority of those who are low in mechanical aptitude are also low in intelligence shows not the independence, but the dependence of these alleged traits.

Another fallacy that should be guarded against is that of assuming that because a certain test, for example, that used by O'Connor at the plant of the General Electric Company, is useful in vocational selection, that is, selecting persons for a particular job, therefore it is equally well adapted to the aim of vocational guidance, helping an individual select an occupation. As a matter of fact these two purposes are distinctly different. Tests which have been named *mechanical tests* might be ever so well adapted to the ends of vocational *selection* without being of much assistance in vocational *guidance.*

Summary and Conclusions. This inquiry into the basis for believing in the existence of a specialized mechanical aptitude has cast distinct doubts on the validity of such a conception. We have examined the evidences that have been brought forward to support the positive side of the argument, and we have objected to them on several grounds.

First, the measures that have been devised have not been proved to be measures, because there has never been established a satisfactory criterion. Practically all the affirmative arguments are based on investigations in which the criteria were nothing but subjective grades given on adolescent boys in shopwork by teachers who themselves did not know what mechanical aptitude was, and whose judgments were subject to the extraneous factors which inevitably influence teachers' marks.

In addition to showing the impropriety of the criterion that has been used, this examination of mechanical aptitude tests points to the impossibility of ever obtaining a valid criterion of mechanical aptitude. Would it not be reasonable to assume that the difficulty which everyone has encountered thus far might mean that there is no such thing as mechanical aptitude?

Second, the contention that there is little relation between mechanical aptitude and general intelligence is not borne out by facts. There is a *positive* relation. Persons who stand high in mechanical work rarely stand low in intellectual achievement. And persons who stand very low in mechanical work rarely stand high in intellectual achievement.

Third, serious objections might be brought against the use of the method of correlation, which is the bulwark on which the defenders of the theory of mechanical aptitude depends. Correlations that are called *high* or *satisfactory* are really not high in forecasting efficiency. Many of them are based on twenty or thirty cases, with a probable error so large as to make them of no significance. The indices of correlation have in many cases been computed without regard to the nature of the regressions. Many more flaws could be found in the statistical manipulations, but space will not permit their complete presentation here.

[9] S. S. Sutherland, Iowa State College, Ames, Iowa, "Correlation Between Intelligence and Skill in Shopwork," INDUSTRIAL-ARTS MAGAZINE, June, 1928.

We conclude, then, that the existence of mechanical aptitude has not been proved. It is only a logical construct — a figment of the imagination invoked as an easy way of explaining something that is not to be so easily explained. As a matter of fact, it is just as reasonable to suppose that the differences in question could be explained by psychoanalysis as to claim that they are due to a fixed innate entity. Indeed, a worshipper of the cult of psychoanalysis could make out a very ingenious case.[10] Likewise, a Behaviorist (in the Watsonian sense) would reject summarily the idea of innate mechanical aptitude, and would offer a much different explanation. All things considered, it would seem to be more nearly in accord with scientific method if investigators abandoned the questionable concept of an entity called mechanical aptitude and, obeying the Law of Parsimony, proceeded on another hypothesis; namely, that *mechanical aptitude* does not exist. It is the contention of this paper that in this way we might make more rapid progress toward the solution of this very important problem of vocational guidance.

[10]Stekel, W., *Disguises of Love*, New York, Moffat, Yard & Co., 1922, Chapters I, VII, and XVI.

Industrial Arts in the Summer Camp

*Stephen Henry Hurtuk**

CAMPING is no longer considered a luxury but a necessity in the lives of our boys during the summer-vacation months when time hangs heavily on their hands. With the growing popularity of this activity, camps for boys are now available within a wide price range, some at a very nominal amount, so that the cost for such a summer's outing for a boy is no longer prohibitive. This fact tends to increase the numbers of boys going to camp each year, and with this increase in numbers there naturally arises the question of how to keep them profitably and properly employed during their stay in camp.

The primary interest of a boys summer camp is, of course, outdoor activities, such as water sports, games, hikes, horseback riding, etc., but there are many times when the boys tire of these organized activities and, in addition to the regular shop periods, will want to drop into the shop and work out a project he finds there, or busy himself with some activity which his own nature suggests. This method of exercising his powers on some shop project of his own choosing, under healthful outdoor conditions such as a camp affords, is one of the chief advantages of any camp.

The logical leader or councilor for this type of shop-work in summer camps is the industrial-arts teacher who gets along well with boys. Such work offers both a pleasant and profitable summer's vacation. The writer has been for the past three summers connected with Cedar Crest Camp for Boys, at Oakland, Maine, as supervisor of the arts and crafts department, and this article is written with the idea that a description of the shops and the shop activities carried on there among the boys may be of assistance to others in organizing this type of work.

This camp has a site of 50 acres of woods and rolling fields bordering on a ten-mile lake. There are from 75 to 100 boys enrolled for the summer, upward from 6 years to college age. The open-air workshops are in spacious buildings overlooking the lake. They are

*Head Auto-Mechanics Dept., Collinwood High School, Cleveland, Ohio, and Supervisor Arts and Crafts, Cedar Crest Camp for Boys, Oakland, Maine.

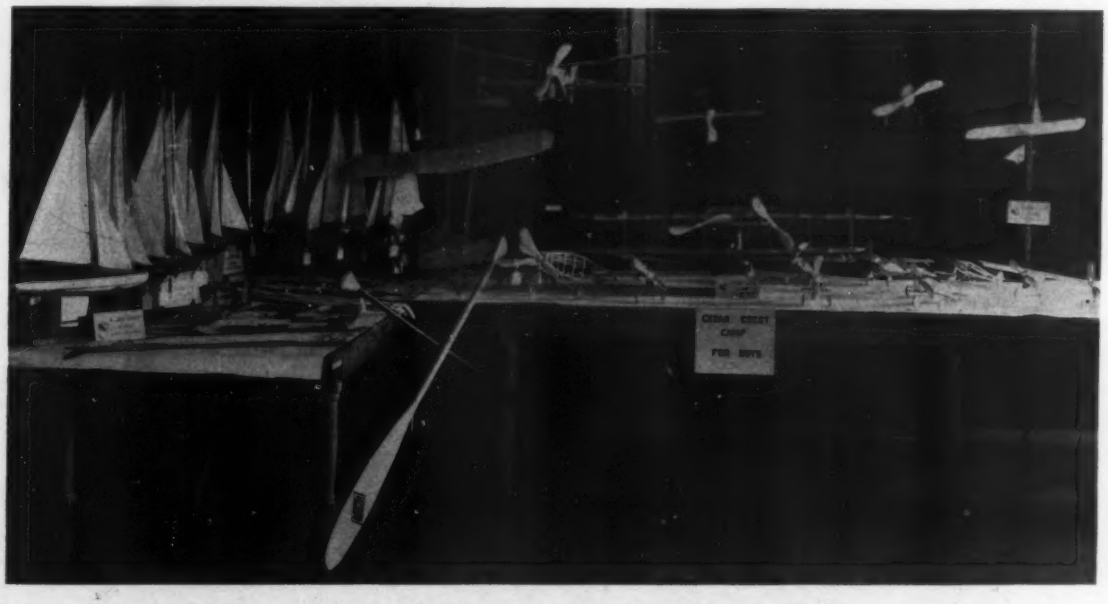


EXHIBIT OF WORK DONE BY BOYS IN SUMMER CAMP

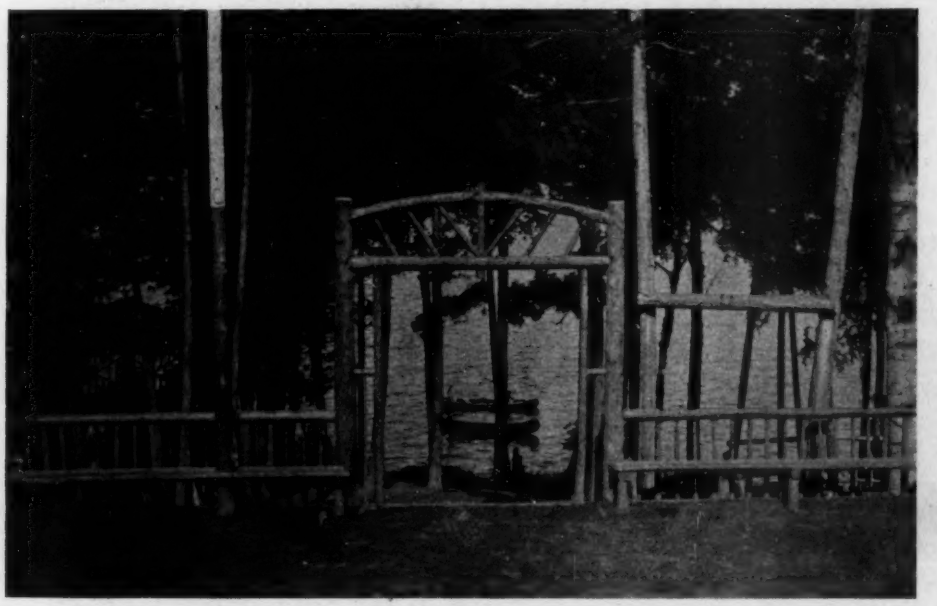
SCENE IN THE CAMP WORKSHOP

ideally planned to admit all the sunlight and air possible. The work is carried on in three separate buildings. In the first shop are the boys engaged on woodworking projects and model buildings, in the second shop the metal and leather work is done, while in the third is located the airplane engines, airplane parts, auto chassis, etc.

It requires considerable ingenuity on the part of the leader to plan worth-while projects and at the same time something the boys really *want* to do where there is such a wide divergence in ages. It was found very helpful to take on some of the older boys in the camp as helpers who assisted in supervising and giving aid on projects when under way.

For the younger boys we feature toys or projects that "go" as we have observed their keen interest in making something with motive power. A great favorite in this class is a small sail and motor boat with its own tiny motor which will carry it some little distance through the water. Excitement runs high when enough boats are completed to hold races. Other popular selections with this group is a grasshopper which really hops when wound up, tops, kites, jumping jacks, rocking horses, and all kinds of jointed and movable toys. A completed sample of each project is on display to aid the boy in making his selection as to what he wishes to make, and he must complete one project before beginning another.

The older boys are greatly interested in leather and metal work. Nearly all of them had an ambition to take home to mother or sister a tooled-leather bag, a pair of book ends, a belt, or some other evidence of



SHORE LODGE

their handiwork while in camp. Some made belts for themselves, bill folds, coin purses, and the like. Others chose to work on metal, making nut bowls, pin trays, book ends, paper knives, belt buckles, etc.

In keeping with the times is the interest the senior boys show in building flying scale model airplanes. As many as 25 boys work on various models at one time. A charter was obtained from the Airplane Model League sponsored by the *American Boy Magazine*, and membership cards and buttons were received. Gliders and tiny models were built, contest flights held and prizes given. Types were featured such as the Fokker, Curtis, N.C.4 Naval plane, DeHavilland, etc. These type models, when properly constructed, will look exactly like the large one, be operated and controlled in the same way, and fly in the air in just the same manner as will its original. Building and flying these model airplanes show all the parts of real airplanes; what each part is for; how real planes are assembled, erected, aligned and covered; what makes them fly, and many other things that could be learned only by practical experience with a real machine. The building and flying of model airplanes is an accomplishment in which every boy is interested and of which he may justly be proud.

The building and flying of model planes furnishes the basis for learning the principles of aeronautics; accordingly, a demand arose from the boys, and this year airplane engines have been purchased from the U. S. Government, an elementary course in aeronautics will be given, following somewhat the course: "Aeronautics in the High School," published in the INDUSTRIAL-ARTS MAGAZINE for July, 1929.

The arts and crafts department closes the season by competing with all the other camps in the vicinity with a public exhibit of work done during the summer. At the close of the season, also, a banquet is held in camp, at which time various prizes and awards are given out to deserving campers. At this time a beautiful silver cup, the arts and crafts award, and one of the most highly prized trophies of the camp, is given to the boy showing the most interest, helpfulness, and development in the arts and crafts subjects during the summer.

A POTTER AT 10. KINGLEY DOUBLEDAY'S SCHOOL, LONDON.
—Keystone Photo.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. Metz, Editor

A RECURRING PHENOMENON

Periodically the newspapers inform the country at large that some city has voted to curtail its school shops, or to abolish them altogether. Just why shop courses in the school should undergo these vicissitudes is difficult to say. It is, of course, reasonable to suppose that if school shops are properly organized and correctly administered, occurrences of this kind could not happen.

However, there may be other factors involved which might explain such occurrences. In many cities, throughout our country, we find industrial-arts and vocational-education work not only well developed, but also thoroughly appreciated. The organization of the work in those communities that look favorably on the school shop, has usually not been an overnight development. Instead, the work began in a modest way and then continued to grow and to improve over a period of 10, 15, 20, or 30 years. Each forward step in the work was thoroughly studied, and alterations and additions were made only as the need for them became apparent.

In some instances at least, the inauguration of this type of work, and the set-up for teaching it, were the products not of the school itself, but of industrial or business organizations, or of civic-minded men. Some of the earlier attempts at apprentice training in the east, the part-time vocational school in Wisconsin, and the trade school at Milwaukee, are examples of educational work of this type which were inaugurated through the direct efforts of influences outside of the school. Work commenced under such conditions is bound to have a foundation, which, with the proper school organization, places it forever beyond the jeopardy of the occasionally misled economist or the political demagogue who, in order to reduce taxes, wants to cut down the educational opportunities offered to the public.

Dissatisfaction with work of this kind is much more likely to arise when an enterprising school administration tries to institute the work by merely copying what has been done elsewhere, without carefully adapting it to home conditions. They forget that foreign plants may not thrive in home soil, and that the work which has become popular in a locality because of the urge or interest of local enterprises may not have the same appeal when transplanted elsewhere. The experimental gap of years during which the work may develop in a natural and logical way may not be leaped with immunity, and educational movements, no matter how worthy, may not be imposed without circumspection.

In those communities where school and industry work together on the solution of the educational problem, little fear need be had that the work in the school will ever be curtailed. Apprentice committees, industrial committees, or other committees consisting of schoolmen and laymen interested in that phase of education which touches upon particular types of human endeavor, do much to give stability and direction to the work of the school and for this reason, these beneficial relationships should be carefully fostered, and made to function more and more in the educational system of our country.

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VOCATIONAL GUIDANCE APPLIED

Vocational guidance is receiving more and more attention in the school, and its range as given by various authorities seems to extend from the kindergarten to the college and beyond. The teaching profession is keenly interested in learning as much about the proper methods of giving vocational guidance as possible, and it is becoming more and more successful wherever it is applied.

This is as it should be, and it is encouraging to find that those engaged in vocational guidance do not feel that they have completely done their duty unless they link placement and follow-up with their guidance work.

While the subject of vocational guidance has been accorded an important place in the curricular offerings of teacher-training establishments, its application to the men in training at these institutions is not always apparent. Of course, there are some teacher-training schools who can truthfully boast that their graduates are usually all placed before commencement day. But this is not a general condition by any means. It would be quite a difficult task for any school to prepare just enough students for any given calling or vocation, because supply and demand are two factors that cannot, in many cases, be established with great exactitude. However, the probable demand may be presaged in the field of teacher training as well as it can be in the realm of any other commodity, and some attention must necessarily be given to this phase of preventing overproduction.

There is another form of guidance, however, which should have a place especially in teacher-training schools. Not every person who wants to become a teacher, even though he is physically and mentally qualified, has the requirements of personality and character which the teaching profession expects of those who enter its ranks. The young man who wants to be a leader of boys and a molder of their characters must thoroughly appreciate that he personally must possess the same character qualifications which he is trying to instill in his students.

The student in the teacher-training school who shows by his action and deportment that his future influence on the young may not be of the best should have his disqualifications for the teaching profession frankly pointed out. The aspirant to the teaching profession who does not want to make the self-sacrifice during his training period which will later on be required of him in his profession, should not be encouraged to go on with his teacher training no matter how brilliant he may be, because his influence can only be detrimental to the students who come under his influence.

This type of guidance is extremely necessary in teacher-training institutions because:

1. It benefits the teacher trainee himself, for it will either alter him or deflect him into channels where his influence may not be so detrimental.

2. It is beneficial to the teacher-training institution because it removes a dangerous influence that may corrupt others preparing for the teaching profession.

3. Most of all, it benefits the future product of our schools — the boys and girls whose lives are influenced for better or for worse by every influence with which they come in contact.

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THE TOUCH OF ART IN INDUSTRIAL PURSUITS

If it can reasonably be held that there is any romance in American industrial life then it must be found in the humble beginnings, the splendid struggles, and the marvelous achievements which have characterized the nation's industrial enterprises. If, on the other hand, it can be asserted that industrialism may experience a new touch of romance, then it would seem that the hand of art must supply the same.

In saying this, we are not here concerned so much with the work of the designer who serves certain industries where art is the immediate and definite factor, as we are with the many industries in which mere harsh utility holds sway, and where art may in some modest way wield an influence.

In many industries articles are produced which could in some manner be improved in form or design or color. The mechanic who is engaged on a given product, may, if he has an eye for art, see some opportunity for changes that will greatly enhance the appearance of the article which he is producing. But even where designers are employed, the individual mechanic may be able to add his mite in giving a new touch of beauty to the thing he makes. We recall here an incident which occurred in a mid-west city some years ago.

A young immigrant who had just arrived from Germany applied to a manufacturing jeweler in a mid-west city for a job. There being no jobs open, the young man was turned away. Just then an unusual thing happened. A large box, containing a shipment of silver plate and silver vases, through some mishap, fell from the sidewalk to the basement floor, causing considerable damage to the contents. The goods were imported from Germany. The immigrant, who had witnessed the mishap, scenting an opportunity, once more applied for a job, but again his application was denied.

He loitered about, and when the twisted and jammed plates and vases were set out upon a shop table in order to estimate the damage, he expressed his ability to restore them to their original form. "I have reason to believe," he said, "that these vases come from a factory in Germany where I was employed. In that particular factory, the employer would allow his mechanics to place their initials on any exceptional piece of work which they produced, especially if they improved upon a given design. That vase over there looks quite familiar to me. I believe you will find my initials on its bottom." The young man's claim proved correct, and he was employed. With the lapse of years he became a member of the firm and an important factor in the industry.

While the story told rests upon a mere coincidence, it nevertheless carried with it a fine lesson; namely, that the art side of things do receive recognition in the field of industry of the old world. It does not necessarily follow that the artistic touch breathed into any particular article will determine its sale in a competitive market, but when the reasons for the popularity of certain articles produced in the older countries are sought, it is found that in their production art has played an important part.

In studying the imports and exports, as applied to our own country, it is found that our exports consist largely of raw materials, food products, heavy machinery, and many articles which do not involve either a finer technical skill, the science of the laboratory, or the touch of art. On the other hand, the imports show many items in which a high order of handicraft together with wonderful expressions in art, is demonstrated.

Every country has its own peculiar way of excelling in the production of certain articles or commodities. Sometimes these conditions are due to local tradition, to a more ready access to raw materials, or to marketing facilities, and sometimes to mere accident or circumstance.

Nevertheless, America's future supremacy in the markets of the world will depend upon her manufactured articles rather than upon her exports of raw material. This being true, the real competition is centered upon articles of production involving a high order of science as well as of skill. Needless to say, a touch of art, coupled to skill and science, will more readily decide the winner of this competition.

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ENGLISH IN THE SHOP

The purpose of this short editorial is not to emphasize the teacher's opportunity for teaching the shop pupil the proper use of English, although that opportunity is always present and should be used as a matter of course, but rather to point out a few factors that should not be overlooked in the teacher's own use of language.

First of all there is the English used in writing instruction sheets, safety warnings, bulletin-board notes, announcements, etc. This should always be of the very simplest. Correct English does not mean large words nor complicated phrases. Some of the greatest truths have come down to us, couched in the simplest language.

Secondly, the teacher's oral explanations should be correct as to pronunciation and every word should be clearly enunciated. The shop period is all too short as it is. There is no time for the student to guess and wonder about what the teacher has said. Every effort should be made to have the students get pronunciation of new trade names correctly from the very start.

Language can convey little or much, depending upon how it is used. To write a good instruction sheet or to outline a good demonstration talk requires thought and study, but the effort pays dividends in the superior results that are obtained.

Free-hand Drawing for Architects

*R. E. Cote**

FUNDAMENTALLY, the architect is an artist who has a fine appreciation of all that is beautiful, is facile with the pencil and has a well-developed imagination.

The essential purpose of free-hand drawing is to equip the architectural student with the necessary freedom of hand so that he can give full play to his ideas and make them realities. Inability to sketch designs on paper is a severe handicap to the student who desires to be something more than a mere draftsman.

The pencil is the best all-around medium to work with, but the architect finds a knowledge of pen and ink, charcoal and water color very helpful also. Charcoal and pencil drawings of the antique are usually included in most architectural courses. If possible, a general knowledge of the human figure and the ability to sketch it will be beneficial in making renderings. All this work should be supplemented by constant practice outside of regular school hours. This is best accomplished if the student will form the habit of carrying a sketchbook at all times, which will enable him to make notes of any particular architectural features that may come to his attention. This is known as "gathering a morgue." He thus accumulates a collection of information that he can refer to at all times. It also teaches him to keep his eyes open and to acquaint him with the architecture of his own city, thus bringing him a step nearer to better citizenship.

The architect must be a thinker, but he must also have a vast amount of vision. First he thinks in free-hand sketches, always working with a bold clear stroke

*Head of Architectural and Art Departments, Boys' Technical High School, Milwaukee, Wisconsin.

STUDYING THE CLASSIC ORDERS

WATER COLORING RENDERING

MODEL OF PRIZE HOME GIVEN AWAY AT THE MILWAUKEE HOME SHOW
Made by the Students of the Architectural Department, Boys' Technical High School. R. E. Cote, Instructor.

until he has his ideas sketched out to his satisfaction. From these he then works with T square and instruments. His ideas are usually presented to a client in the free-hand, sketchy form as they present a much clearer picture than complicated working drawings. Sometimes sketches are augmented with a suggestion of color, either colored crayons, pencils or water color.

The course in free-hand drawing for the architectural students given in Boys' Technical High School contains every art element usually associated with architecture. It is presented in such a way that it coördinates with the work of the student in the drafting room. A thorough grounding in rendering wash drawings occupies the first semester in art, which comes at the same time that he works on the Classic Orders in his third semester of drafting-room work. When the student has finished the mechanical part of his drawing, in the drafting room, he takes it to the art department for rendering. At the very start of the semester he is given a grounding in the process of determining shades and shadows and the laying on of graded washes.

The second semester of artwork is spent in familiarizing the student with the use of charcoal, pen and ink, pencil and water color. He is required to keep a notebook in which he must make notes of architectural features which he sees from time to time. In coördination with this, the drafting room is teaching mechanical perspective so that toward the last of the semester the boy will be found making a water-color or a pencil, or a pen-and-ink rendering of the mechanical perspective that he has drawn in the drafting room.

The final semester is an advanced course in free-hand rendering of interiors, elevations, and perspectives, concluding with the construction of a model house plus the landscaping of the surrounding grounds. This last constitutes an accumulative record of all the knowledge which the student has retained from his previous work.

Grading System for Drafting

*Rowland L. Hill**

AFTER making a careful study of grading systems, the chart illustrated herewith, was evolved. It has been found to work out very satisfactorily during the two years of its existence.

The minor items have been revised several times, and they now cover about everything that a student in drafting should be checked up on.

The addition of references for each of the items enables the students to get the best of criticisms from the various authors and to find complete explanations on any points of weakness. Each instructor can insert in the blank spaces any references which may be available, and under each reference indicate the page on which the information may be found.

With a large class it is impossible to give as much personal assistance to each student as might be desirable, and with certain students these references will give all the explanations necessary. The grade that a drafting student receives does not make a better draftsman out of him, but it is the constructive criticisms and personal help that will.

The drawings should be graded and returned not later than the next class meeting after the drawing was turned in, in order to obtain the best results.

*Vocational School, Jackson, Michigan.

GRADING SYSTEM BY R. L. HILL — DRAFTING — REFERENCE BOOKS

MAJOR ITEMS	INDEX LETTER	PER CENT VALUE	MINOR ITEMS	DRAFTING OR ENGINEERS
LAYOUT PERFECT SCORE 25%	A	15	WRONG PROJECTION.	48
	B	4	VIEWS NOT WELL BALANCED, SPACE BETWEEN VIEWS UNEVEN.	103
	C	3	SELECTION OF VIEWS COULD HAVE BEEN BETTER.	103
	D	3	ARRANGEMENT OF PARTS COULD BE BETTER.	103
LINE WORK PERFECT SCORE 18%	E	5	VISIBLE OR INVISIBLE OUTLINE OMITTED, USED WRONG LINE.	47
	F	3	CENTER LINE OMITTED, NOT PROPERLY MADE.	11
	G	2	LINE NOT PROPERLY MADE,	11
	H	2	WRONG CROSS HATCHING.	113
	I	2	LINES NOT UNIFORM IN WEIGHT.	11
	J	2	NOT ENOUGH DIFFERENCE IN WEIGHT OF LINES.	11
	K	2	CONSTRUCTION LINES ARE TOO HEAVY.	—
DIMENSIONING PERFECT SCORE 19%	L	5	WRONG DIMENSION, DIMENSION OMITTED, NOT TO SCALE.	64
	M	4	NOTE OMITTED, NOT CLEAR, POORLY LOCATED.	64
	N	3	ARROWHEADS COULD BE BETTER, OMITTED.	64
	O	3	EXTENSION OR DIMENSION LINE NOT PROPERLY MADE.	64
	P	2	DIMENSIONS CROWDED, NOT UNIFORM, POORLY LOCATED.	64
	Q	2	FINISH SURFACE NOT INDICATED.	71
LETTERING PERFECT SCORE 15%	R	5	WRONG STYLE, WRONG SLANT.	18
	S	4	HEIGHT OR WIDTH NOT UNIFORM.	15
	T	3	SPACE BETWEEN LETTERS OR WORDS WRONG.	19
	U	3	MIS-SPELLED WORD, GUIDE LINES TOO HEAVY.	—
NEATNESS PERFECT SCORE 15%	V	5	LINES POORLY CONNECTED.	11
	W	4	UNNECESSARY LINES OR MARKS ON PAPER.	—
	X	2	LINES, LETTERS OR FIGURES NOT UNIFORM, KEEP PENCIL SHARP.	2
	Y	2	TOO MANY CHANGES OR ERASURES.	—
	Z	2	PAPER IS DIRTY, FINGER PRINTS SHOW.	—
TIME PERFECT SCORE 6%	+	5	EXCEPTIONALLY GOOD TIME	
	+	3	ABOVE AVERAGE	
	±	0	AVERAGE	
	−	3	BELOW AVERAGE	
	−	5	VERY SLOW	

How to Use the Chart

Suppose that a drawing is to be corrected on which some of the dimensions are crowded. Under the major item of "Dimensioning" find the minor item which mentions this fault on the drawing. The index letter for crowded dimensions is P. Place the letter P on the drawing, preferably outside the trim lines. If the instructor is not sure that the student will know just which dimensions he has reference to, the note should be written thus, P (dim. 5/16 and 7/8r). This should be repeated for all mistakes on the drawing. This method also saves marking up the drawings with a lot of unsightly lines and notations.

To determine the grade, add up the per-cent values of all the letters or items checked and subtract from 100. Then if time is considered, add or subtract the per-cent values as indicated according to above or below average time. Mark the drawing as "Time + 3%."

WORK REPORT SHEET

Name *G. Helpop* Class *Senior*
Job No. *82* Title of Job *Swivel Base*
Date Started *Jan. 12* Date Completed *Jan. 14*
Time *2* Date *Jan. 12* Material *Cast Iron*
Time *3* Date *Jan. 13* Material.....
Time *1¼* Date *Jan. 14* Material.....
Checked..... Grade:.....
Remarks:

FIG. 1

Figure 1 shows a sample of a time card which can be used by the student to keep a record of his time.

The student should correct the drawings that have been returned to him. No drawing should be finally accepted until the student has, as far as his ability permits, succeeded in making a perfect drawing.

Several of these grading charts may be posted around the room, or better still, each student should be given one so he can check his own drawings before he turns them in to be graded.

Most students will not aim any higher than the standards that are set up for them. Why not set a proper goal.

OPPORTUNITY

No age has ever presented the tremendous opportunities of the present. With the changing wheel of ambition, boys no longer regard the talkative professions as more important than the manual. They realize that there are gigantic tasks to be done, and that these will be accomplished by doers rather than talkers. The man who does things is vastly more important to the world than the one who merely makes the record of others' achievements. — *Henry Ford.*

TRADE-EXTENSION WORK

The most effective vocational education today is that being done with pupils over 16 years of age. The best form of vocational education is the trade-extension type which takes people already employed in a trade and carries them forward. — *F. T. Struck.*

TRACING SUPPLEMENT No. 178,
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION,
JUNE, 1930

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RELATED INFORMATION FOR SHEET METAL WORK

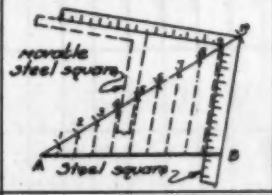
BY C.H. DERBY & J.F. FABER

GEOMETRICAL DRAWING

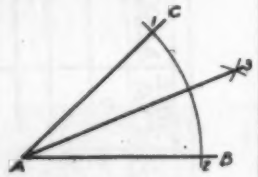
To bisect a line

To erect a perpendicular to a given line at a given point

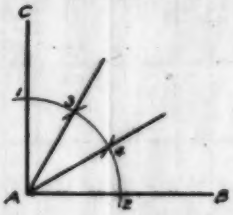
To divide a line into any number of equal parts



To bisect an angle



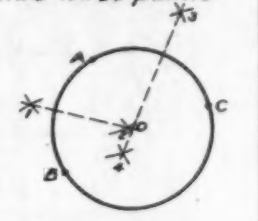
To trisect a right angle



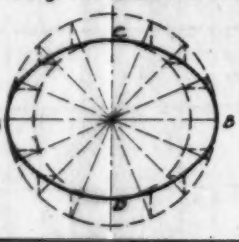
To inscribe a regular hexagon in a circle

To inscribe a regular octagon in a circle

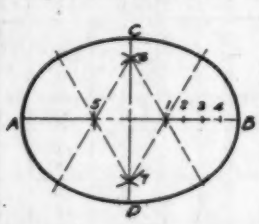
To draw a circle thru three points



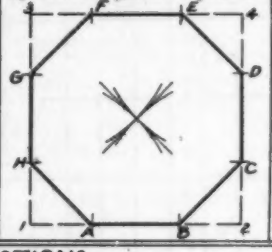
To draw an ellipse – axes given (exact method)



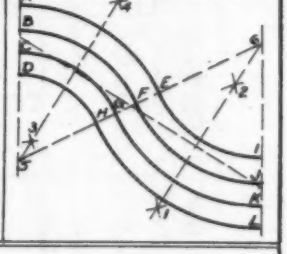
To draw an ellipse – axes given (approx method)



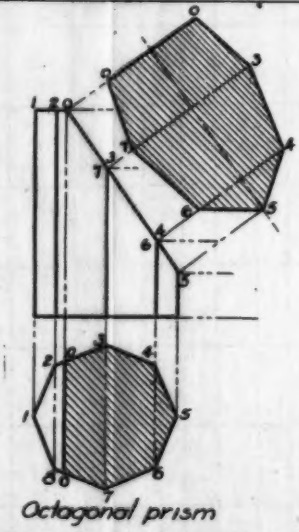
To inscribe a regular hexagon in a given square



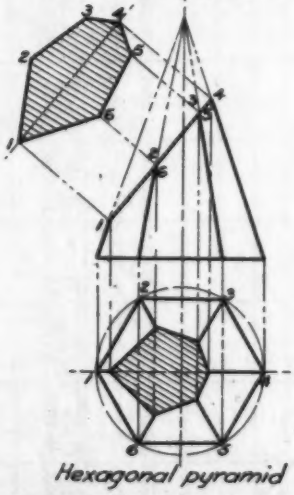
To draw parallel reverse curves



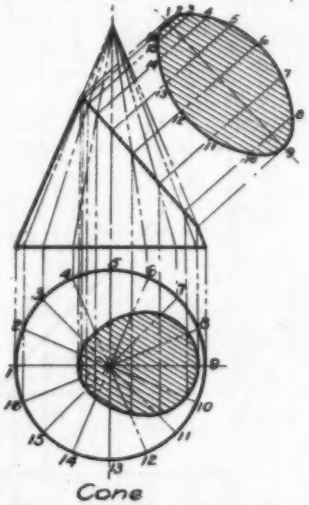
PROJECTIONS



Octagonal prism



Hexagonal pyramid



Cone

–GENERAL INFORMATION–

If ears or handles are to be placed on a cylindrical or conical article, the best time to mark their location is while the metal is in the flat.

If this is not done, it may be found in the manner indicated above by use of the steel square.

The circumference of a circle equals the dia. times 3.1416

The area of a circle equals dia. squared times .7854.

To find the contents in gallons of a cylindrical article – square the dia. in inches, multiply by the height in inches and by .0034

231 cu. in. = one u.s. gallon

31½ gallons = one barrel.

To obtain the radius to lay out a pitched cover – measure the dia. of the rim from outside to outside of burr. Take one half this dimension on one edge of the steel square and the desired raise on the other edge. The distance between these points is the radius of the cover.

Designed by C. H. Derby and J. F. Faber, Erie, Pa. For Description See Page 229, Industrial Arts and Vocational Education, June, 1930

TRACING SUPPLEMENT No. 179,
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.
JUNE, 1930

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ELE. WOODWORK
CLIFFORD B. SMITH

SHELLAC

UNIT INSTRUCTION SHEET F-1

-A-

WHEN APPLYING SHELLAC TO A FLAT SURFACE START THE STROKE NEAR THE CENTER AND WORK TOWARD THE EDGES. APPLY QUICKLY, DRY BRUSH ON EDGE OF CONTAINER, REMOVE BUBBLES AND SURPLUS SHELLAC AND TOUCH NO MORE 'TILL DRY.

ALWAYS SAND SHELLAC WITH FINGER-TIPS AND A SMALL PIECE OF FINE PAPER. WORK WITH THE GRAIN.

-B-

WHAT IT IS— Shellac is a resinous substance obtained from the branches of a tree found in southern Asia. A gum-like substance exudes from the tree due to the stings of certain insects, who become imbeded themselves in the mass that gathers.

Natives gather this gum, which after being cleaned is warmed in sacks before fires, the gum or lac melting thru and falling on sticks of wood. When dry, it is in flakes and shell like pieces, hence its name shell lac or shellac. It is orange in color. Dissolved in denatured alcohol it is the orange shellac you are familiar with.

KINDS— There is the natural orange shellac, which can be obtained either in the flake or in the liquid state and also the white shellac which is formed by bleaching the orange.

Orange shellac is the better in quality of the two, but white shellac is preferred for much work because of its transparency and lack of an orange cast.

DIRECTIONS FOR USING—

1— There is no easy way to a good finish. Shellac is a spirit varnish and as a finish comes under the varnish group. As with all interior finishes, it requires a perfect surface on the wood before it should be applied. This means unending care in the preparation of the surfaces to be finished. A good finish requires more time and effort than the making of the project itself.

2— Is the work or project ready for the shellac? Not unless each of the following steps have been taken.

a— Are all plane and mill marks removed? Hold each surface so that you get a good light to enable you to see the slightest flaw. Try to see them!

b— Is every surface sanded so carefully with the grain, that you cannot see the slightest sign of cross sanding? Not even one scratch!

c— If the wood is chamfered, are these surfaces straight and true, with clean-cut arrises

d— Are all arrises slightly rounded? This should be done to prevent nicks and wearing thru the color.

e— Are all cracks and dents smoothly filled to the color of the stain?

f— If working directly over stain, has it been lightly sanded, as shown at -B-. This coat should be orange shellac. Is this stain thoroly dry?

h— If applying shellac for the second or third coats, were the first coats thoroly dry and sanded dead smooth, as at -B-? The second and third coats should be white shellac.

-C-

3— Is the shellac in condition to use?

a— Does it run from the brush with about the consistency of milk? If thick, thin with alcohol.

4— Is all dust removed from the work with a slightly damp cloth?

5— When applying shellac on small flat surfaces start at middle and brush toward the edges.

When working on objects with out-of-the-way corners, start with these difficult places and work toward the outside.

After applying a little shellac, dry out brush and pick up all bubbles and runs.

Do not work the same coat over and over. Allow it to dry about 8 hours.

6— Each coat, even the last, should be sanded, as shown at -B-, dead smooth with 00 paper. The last coat will be rubbed with the grain with pumice and oil and then rotten stone and oil. Use a clean felt pad

7— Clean brush and hang up as shown at-C-

QUESTIONS— What is a finish? Name the two important things every finish must do. To which of the four main types of finishes does shellac belong? How do these different finishes compare with each other? Why should bare wood be sanded in almost every case with a sand block? Why should a stained or shellacked surface never be sanded with a sand block? Why rub with the grain?

Designed by Clifford B. Smith, Buffalo, New York

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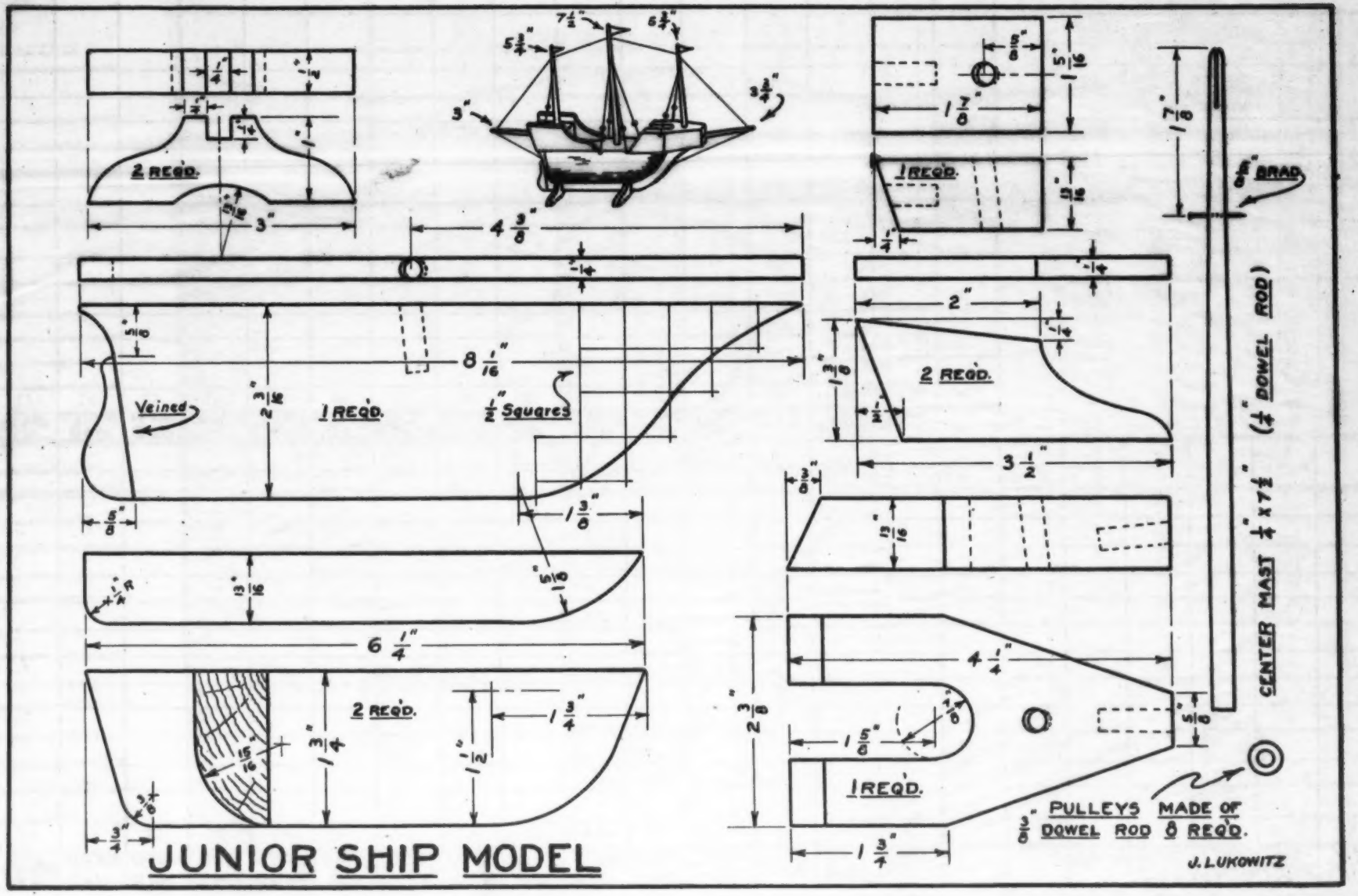

Designed by Jos. J. Lukowitz, Milwaukee, Wis.

For Description See Page 229, Industrial Arts and Vocational Education, June, 1930

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INDUSTRIAL ARTS AND VOCATIONAL EDUCATION,
JUNE, 1930

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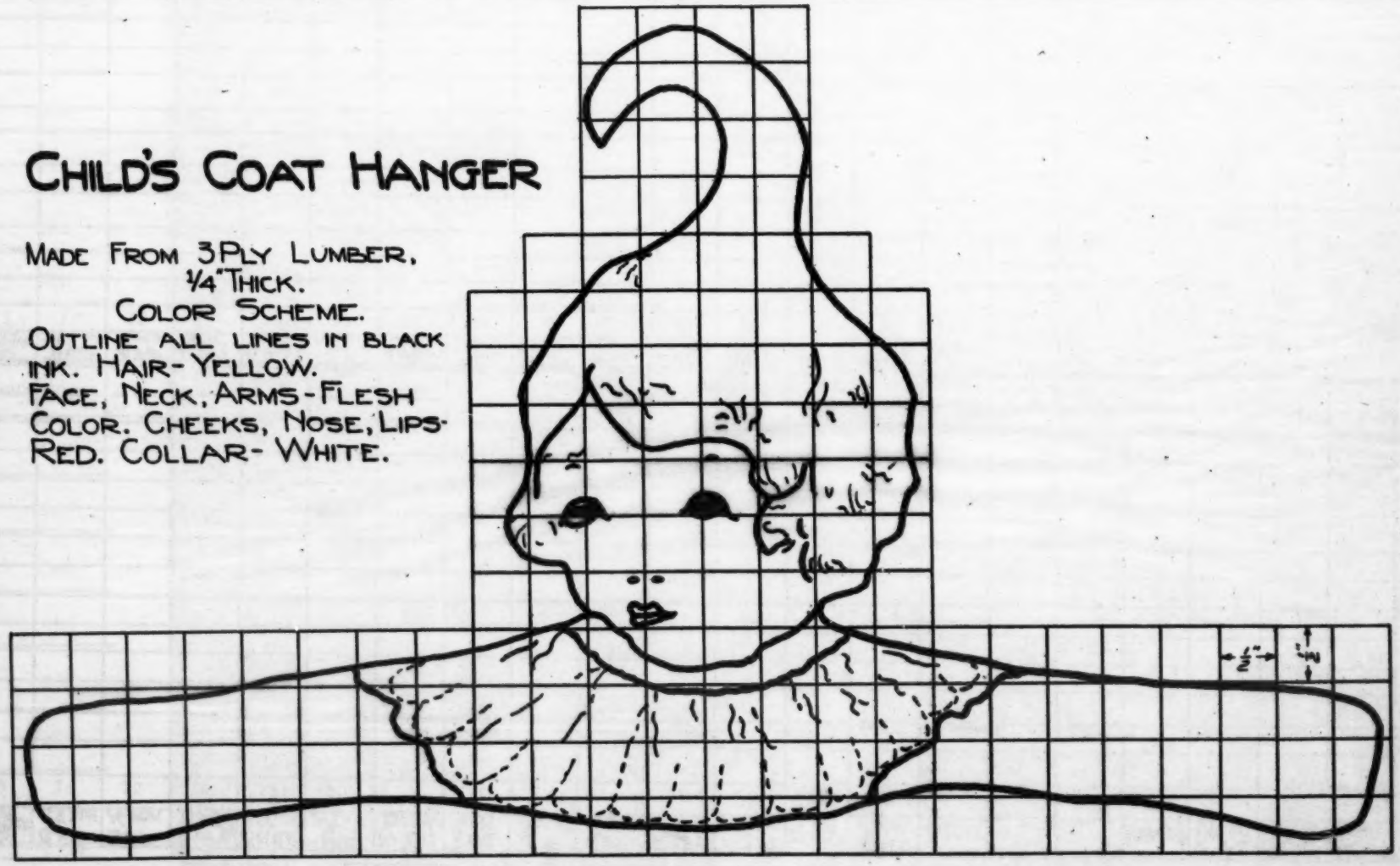
CHILD'S COAT HANGER

MADE FROM 3 PLY LUMBER,
¼" THICK.
COLOR SCHEME.
OUTLINE ALL LINES IN BLACK INK. HAIR - YELLOW.
FACE, NECK, ARMS - FLESH COLOR. CHEEKS, NOSE, LIPS - RED. COLLAR - WHITE.



Designed by Wm. Windsor, Jr., Gloversville, N. Y.

For Description See Page 230, Industrial Arts and Vocational Education, June, 1930

PROBLEMS AND PROJECTS

This department aims to present a wide variety of class and shop projects in the Industrial Arts and Vocational Education. Successful problems are invited and will be paid for. A brief description of constructed problems, not exceeding 20 words in length, should be accompanied by a good working drawing. The originals of the problems in drawing and design should be sent.

Problems in woodworking, turning, patternmaking, machine-shop practice, sheet-metal work, forging, foundry work, auto mechanics, auto electricity, electricity, architectural and mechanical drafting, printing, bookbinding, concrete work, farm mechanics, home mechanics, and other lines of industrial-arts work are desired for consideration.

JUNIOR SHIP MODEL

Jos. J. Lukowitz, Milwaukee, Wisconsin

(See Supplement No. 180)

The ship illustrated herewith was designed so that its construction will not be beyond the skill of a sixth-grade boy. Many of these boys look wistfully at the larger models which are too difficult for them to make. The sense of achievement which they enjoy after making this very simply designed boat satisfies that constitutional desire, that of the average boy to make a boat. It is well therefore to capitalize this great interest and enthusiasm, and inculcate the several tool operations involved in the contruction of this boat.

The number of parts required to construct this project has been reduced to the minimum, yet when assembled, they have a presentable appearance. The small sketch in Figure 1 illustrates how the boat looks when finished. An appearance of age may be given to it by staining it with a dark-brown oil stain.

Figure 2 illustrates this same ship with slight changes in the construction and several additions to the rigging and trimmings. It may be desirable to have the boys decorate and rig their boats at home. This type of industrial home-work should be encouraged, for it has both immediate and future values for the boys.

RELATED INFORMATION FOR SHEET-METAL WORK

C. H. Derby and J. F. Faber, Erie, Pennsylvania

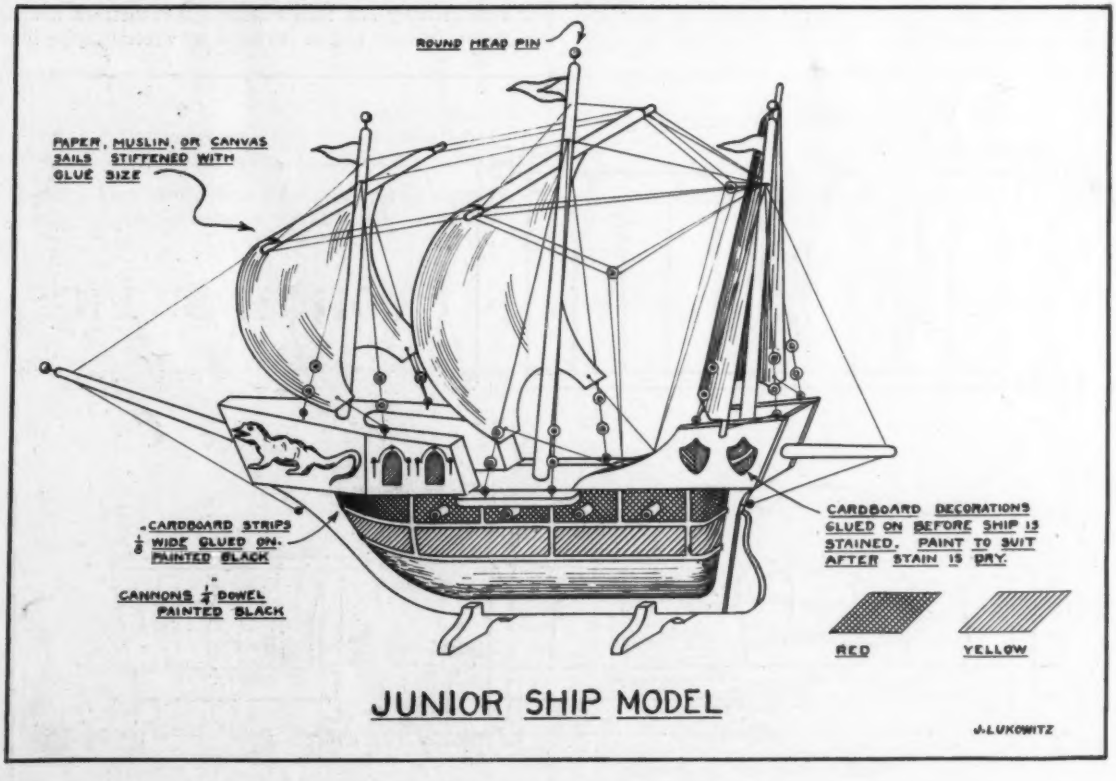
(See Supplement No. 178)

The chart entitled "Related Information for Sheet-Metal Work" was devised for use in the drafting room and the sheet-metal layouts. It acts as a constant reminder of principles and methods involved in layout problems.

The geometrical problems were selected as the ones most important and most often used in both drafting room and shop.

The problems in projection include parallel line and radial line development, and show the relation between plan views and elevation. The method of developing auxiliary views is also shown.

The general information shows shop kinks that are useful and time-saving; also some of the more common mathematical operations and constants that a sheet-metal worker is called upon to use. These constants should be committed to memory.


ROUND HEAD PIN
PAPER, MUSLIN, OR CANVAS SAILS STIFFENED WITH GLUE SIZE
CARDBOARD STRIPS ⅛ WIDE GLUED ON. PAINTED BLACK
CANNONS ¼ DOWEL PAINTED BLACK
CARDBOARD DECORATIONS GLUED ON BEFORE SHIP IS STAINED. PAINT TO SUIT AFTER STAIN IS DRY.
RED
YELLOW
JUNIOR SHIP MODEL
J. LUKOWITZ

CHILD'S COAT HANGER

Wm. Windsor, Jr., Public Schools, Gloversville, New York

(See Supplement No. 181)

This project has been found to work out very satisfactorily with a group equipped with only coping saws, wood files, and sandpaper, as well as in the up-to-date vocational school.

For a beginning class in woodworking, it would be advisable to make a template of the hanger and then have each pupil trace its outline on his material.

In an advanced class, each pupil may be allowed to make his own template on graph paper having ½-in. squares. In this way drawing may be combined with woodworking.

The material which works to best advantage, is a three-ply lumber having either basswood or poplar surfaces. Beaver Board, Upson Board, or other similar composition material may be used if so desired.

Be sure that the teeth of the coping-saw blade point toward the handle, then saw along the outer edge of the penciled outline. Next file any rough or uneven places, using the wood file. The entire hanger is then thoroughly sanded. If composition board is used in place of plywood, the edges should be carefully smoothed with a fine file. Do not sand at all.

In finishing the hanger, the color scheme suggested may be varied to suit one's individual taste. On plywood, paints mixed in turpentine, gasoline, or oil may be used; also lacquers. While on composition material, water colors or inks should be applied.

A shop equipped with a band saw could produce many of these hangers at small cost to be sold for the purpose of raising money for school activities.

PORCH SWING

J. E. Ray, Waukegan Township High School, Waukegan, Illinois

The porch swing shown herewith is both ornamental and interesting. It has many pleasing curves that will tax the usual student in high school. However, a good student could make this and finish it in a reasonable length of time.

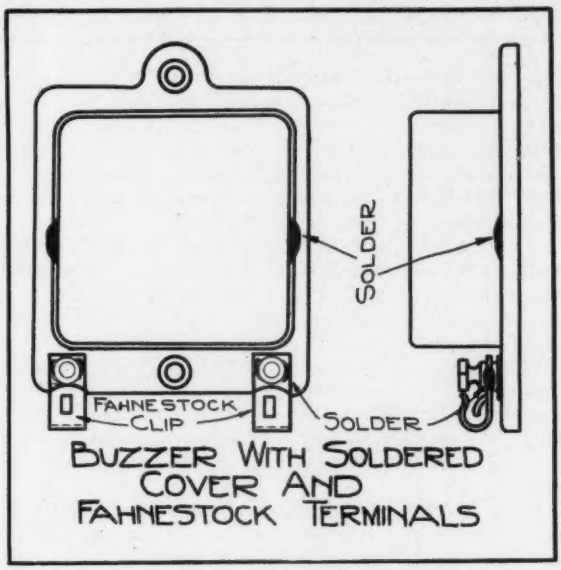
The hardware and fastenings are not shown, but their application can be easily seen. The swing may best be built of oak, and stained a dark, weathered-oak color. It should then be varnished and rubbed to a dull finish.

Porch swings should be well made, because they are required to carry unusual loads at times. The chains should be quite strong and the hooks in the porch-ceiling joists well anchored.

PREVENTING BELL AND BUZZER TROUBLES

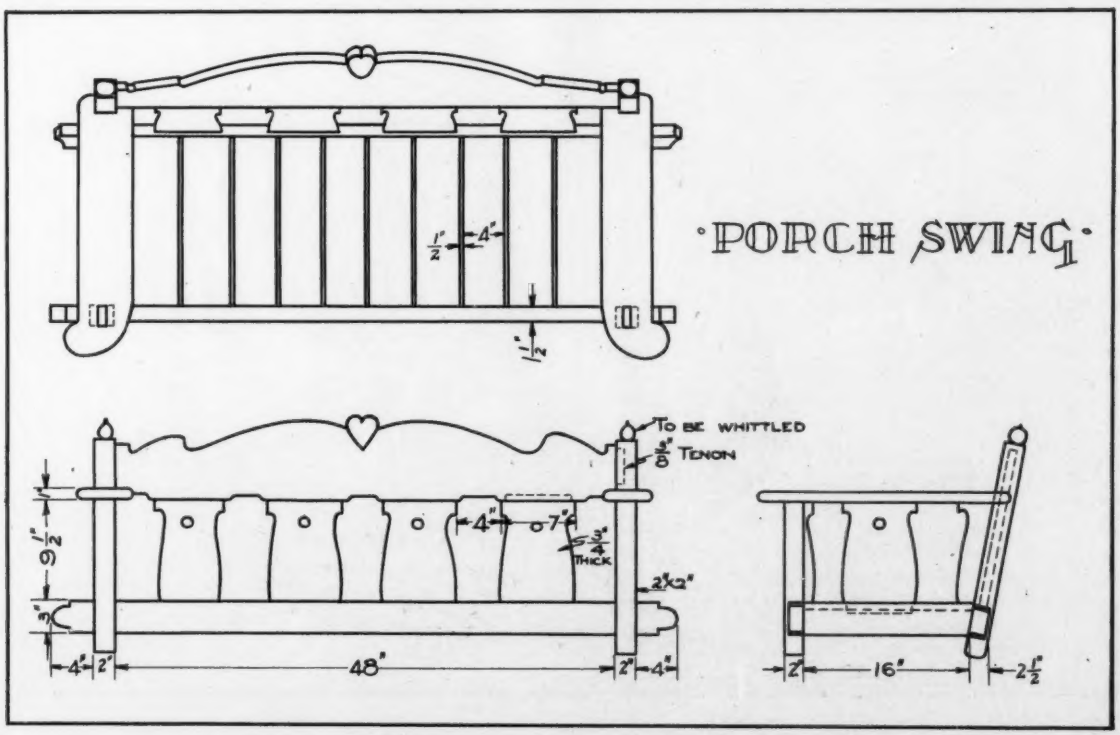
E. A. Rerucha, Wakefield Township Schools, Wakefield, Michigan

Due to the constant making and taking down of connections, the terminals on electric bells and buzzers in the school shop become loosened, threads are stripped, and often the



BUZZER WITH SOLDERED COVER AND FAHNESTOCK TERMINALS

nuts lost. This trouble may be overcome by tightening the lock nuts securely and then fastening a Fahnestock binding post under the large nut, as shown in the accompanying illus-



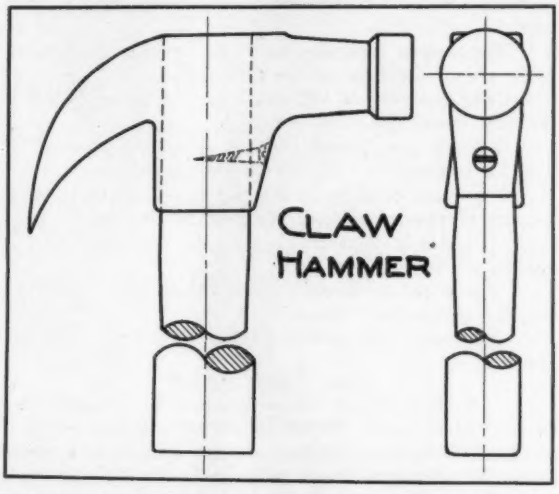
tration. Then solder both nuts and clip together. This will keep the terminals from working loose and insures a good connection with the inside bell circuit, thus doing away with the annoying troubles of loose or lost terminal parts.

Boys also have a tendency to adjust every bell or buzzer, even though it may be working satisfactorily. The ordinary commercial type of bells or buzzers not equipped with an adjusting screw for this purpose suffer as a consequence, because repeated bending or adjusting of the breaker points will loosen the parts or break them off entirely. This frequent adjusting is not ordinarily necessary, and a new bell or buzzer, or one properly adjusted, will remain in working order for a long time. After a boy has once learned how to adjust a bell, the principal features of other bell problems is the hook-up of the circuit and not the adjusting of the bell. To prevent tampering therefore, the writer uses bells and buzzers on which the cover has been soldered to the frame, as shown. Since this method was adopted, it has reduced the work of keeping bells and buzzers in working order to a minimum.

HOLDING THE HAMMER ON THE HANDLE

H. A. Allender, Head of Manual Arts Department, Bristow, Oklahoma

In the school woodwork shop the claw hammers are subjected to severe service. Sometimes they stay on the handle,



sometimes they don't. The illustration shows a quick, efficient way to put the hammer on the handle to stay.

1. Put the hammer on the handle in the ordinary way, using a wedge if desired.
2. Drill a 3/16-in. hole as shown.
3. Countersink the hole.
4. Drill a hole in the handle for screw, using a Yankee drill and a No. 5 Yankee-drill bit.
5. Use a No. 9 flat-head screw, 1 in. long.

This makes a neat elementary problem in bench metal work.

THE ALTERNATING CURRENT

(A Sample Informational Lesson for Students of Electricity)

Harold Trelease, Essex County Vocational School, Orange, New Jersey

Electric currents supplied from a battery are described as *direct currents,* because they flow in one direction throughout the circuit.

There is another kind of electric current, which has the property that, instead of flowing in one direction along a conductor, it is continually flowing forward and backward in rapid alternations of directions.

The term *alternating current* is now used to mean a flow of electricity which is continually rising and falling in value, or, as stated before, is flowing forward and backward.

To fully understand the nature of an alternating current, one must consider that it not only flows first in one direction and then in the other in a circuit, but also *rises* and *falls* in value between zero and a maximum at each reversal of direction. The current pulsates, each succeeding beat being in an opposite direction to the preceding one. The rise and fall of the current may be altered due to disturbing effects, but this disturbance cannot change the direction of flow.

This property of *rising* and *falling* in a reverse direction through the circuit is *independent* of the *magnitude* of the flow of current. As soon as any alternating current, (no matter how small), begins to flow, it rises and falls with each reversal at each period, and the total amount of *rise* will increase according to the *quantity* of flow.

Supposing a current of 20 amp. to be flowing. It will start at zero, then rise to full value, and decrease to zero again. During this entire period of time it has been flowing in *one direction.* After falling to zero it will rise again to full value, but in the *opposite direction,* and then fall to zero. Should the current be reduced to 10 amp. instead of 20 amp., the *rising* and *falling* will go on as before, but the full value will only be 10 amp. An alternating current, therefore, differs from a continuous current in *two* respects, one being that its rate of flow is always changing, and the other being that its direction is reversed at regular intervals of time.

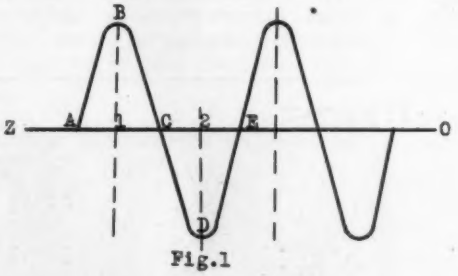


Fig.1

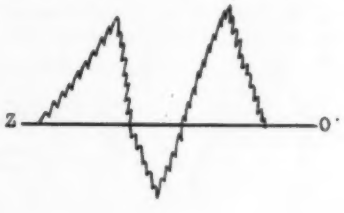


Fig.2

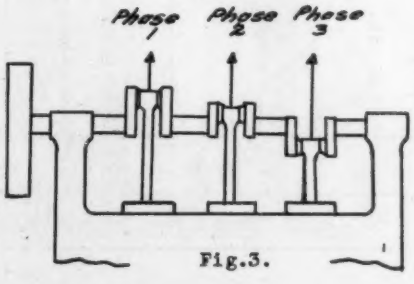


Fig.3.

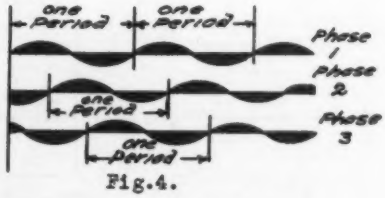


Fig.4.

Diagram of pulsations of Alternating Currents.

It is this kind of current, *rising* and *falling* between zero and full value, and also continually reversing in direction with each period of rise and fall, which is called an *alternating current.*

A current of this kind can produce many of the effects produced by direct currents. It can be used to drive motors, excite magnets and solenoids, light incandescent lamps, etc. Alternating current *cannot* be used for charging storage batteries, electroplating, and electro-depositing baths, or operating radio sets, *unless* its *character* is changed so that there is no *reversal* of *polarity.* It is then not an alternating current, having been *rectified,* though it may rise and fall, but the impulses are in one direction throughout the circuit.

The usual method of representing alternating current by diagram is shown in Figure 1. The line ZO represents zero, and the distance B or D above or below the line represents the maximum amount to which the current rises. The distance AC or CE represent the interval of *time* which elapses between the *rise* of the current and its *fall* to zero again. If A to C represents 10 seconds, then the current reaches its *maximum* at an interval of five seconds, represented by A1. It then commences to *fall,* and reaches zero at a further interval of five seconds, represented by 1C. At this instant the voltage changes its polarity, and with the current repeats the *cycle* through CDE, attaining its *maximum* at C2, and, passing through zero again at 2E. The polarity now *reverses,* and the *cycle* ABC is repeated.

The *time* interval AE represents a complete *period* of alternation. For electric lighting and power work the current may rise, fall, and reverse, as shown by the double curve from A to E, 60 times in one second. When speaking of the rapidity of reversal in alternating-current theory and practice, it is referred to as the *frequency* or *periodicity* of the current. This makes clear that both curves ABC and CDE are included as a *period.* Disturbing effects in the current will produce ripples on the wave of the current, but, the wave as a whole, with the ripples, will continue its undulatory movement, as shown in the diagram in Figure 2.

Essential Features of Three Phase. In Figure 1, it is shown that in the periodic changes that recur, the alternating current is of zero value twice in each period. Thus an alternating current of 60 periods per second dies down to zero 120 times a second. The flow of energy conveyed by such a current is *pulsatory.* This is similar to that which occurs mechanically in any single-cylinder engine. There are two dead points in each revolution, where the crank has no leverage and the piston can exert no turning effort. Engineers get over this difficulty by designing engines with two or three cylinders, requiring two or three cranks. (See Fig. 3.)

The three-phase system of currents consists in the employment of three electric currents, which are each alternating with the same *frequency,* and are of equal *amplitude,* but which, like the pistons of a three-cylinder engine, are arranged not to be in step one with the other, but to follow one another in regular succession as is shown in Figure 4. As is shown, the three phases or currents are named phase 1, phase 2, and phase 3. Observing the diagram closely will show that if time be represented by horizontal distances, each period being represented by an inch, the zero of the current in phase 2 is one third of an inch to the right of the zero of that in phase 1, therefore the current of phase 2 is one third of a period out of step with the current of phase 1. The current of phase 3 is another one third of a period behind the current of phase 2, or two thirds of a period behind that in phase 1. So the pulsations of the three currents come in regular succession, one third of a period apart like the recurrences of the three cranks of a three-crank engine in the order, 1, 2, 3 — 1, 2, 3 — 1, 2, 3, etc.

SELECTING TYPE FACES

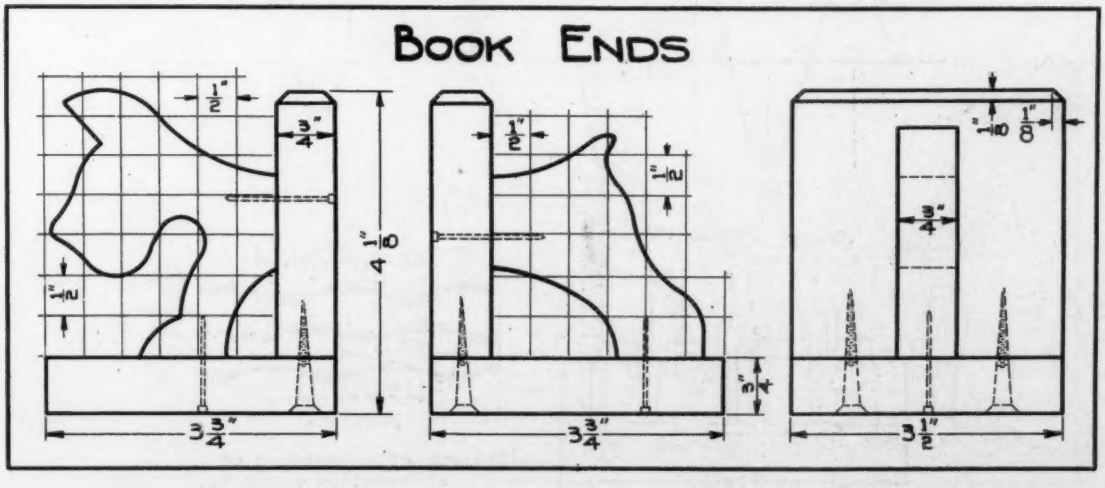
A typical related-materials lesson for the school printshop
Leroy Brewington, Senior High School, Pittsburg, Kansas

1. Do not sacrifice legibility, dignity, or purpose for novel or unusual faces. Remember, type is made to read.
2. Roman type, either modern or old style, is the easiest to read.
3. Lower case is more easily read than capitals.
4. The classic roman letter is the superior letter-form. Its legibility and color distribution is not equaled by any other type.
5. The modern type, especially the imported modernistic faces, are most popular at the present time.
6. Using modern and old-style types of roman letters in the same design should be avoided.
7. Old-style type is most effective on antique papers.
8. Modern type is most effective on coated papers.
9. It is more desirable to use the lighter roman types on account of the strong color produced by the heavier faces.
10. It is rarely necessary to use more than two styles of type in the same design.
11. Condensed or extended letters should not be used with regularly proportioned letters.
12. Condensed and extended letters should never be used together.

DOG BOOK ENDS

A. J. Roiseland, Durfee Intermediate School, Detroit, Michigan

This is a practical problem in bench woodwork. It differs from the ordinary book end inasmuch as the dog used is cut in half, and each half placed in position on the supports. When the book ends are in use, it appears as if the little dog were dashing through the books. This novel idea appeals to the seventh- and eighth-grade boy, and gives him a great deal of incentive in completing this project.



Three-quarter-inch wood is probably best suited for the problem. Gum, bass, birch, or pine may be used. The dog is traced from a pattern, and cut out with a coping saw. After it is sawed out, the outline is smoothed with a rasp and sandpaper. The upright supports are made according to the dimensions shown. When cutting the dog in half, use a miter saw. This makes the cut perpendicular to the base line, so that a good butt joint is obtained where the feet and back touch. The dog is fastened with glue, and with a wire brad.

Many color combinations can be worked out in painting. One suggestion is to paint the body of the dog black and the nose and the top of the tail white. The supports may be painted a green or left natural color. By constructing a metal template, one can draw on the dog the portions which are to be painted white or black.

This problem accomplishes many exercises, such as laying out, squaring stock, chamfering, drilling, countersinking, use of miter saw, use of screws and nails, and assembling.

OXYACETYLENE WELDED CAMP OR BRIDGE CHAIR

R. F. Jennings, South High School, Minneapolis, Minnesota

This project may be welded up of steel airplane tubing, but it can also be made of ⅜-in. black iron pipe.

Material Needed:

⅝ in. O.D. steel tubing of ⅜ in. black iron pipe as follows:
- 2 pieces 17½ in. long
- 2 pieces 20 in. long
- 2 pieces 19½ in. long
- 1 piece 12¾ in. long
- 1 piece 15¾ in. long

1 piece 16-gauge sheet steel, 15⅛ by 3 in.
1 piece ¼ in. steel filler rod, 14 in. long
1 piece 10-oz. canvas, 14 by 27 in.
2 1/16 by ¾-in. cotter pins

Tools Needed:

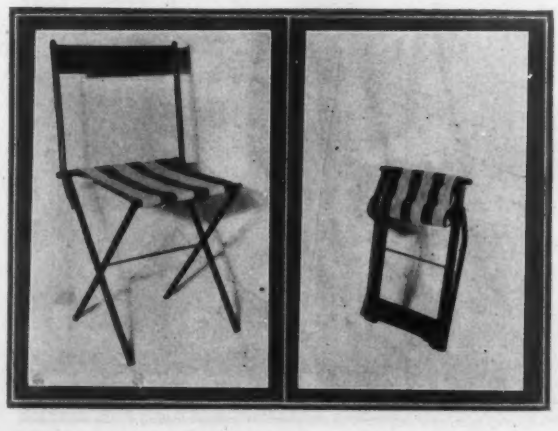
No. O welding tip if tubing is used or No. 3 if pipe is used. Use No. 3 tip for brazing in either case.
Hack saw
Hammer
Center punch
17/64 in. drill and 5/64 in. drill

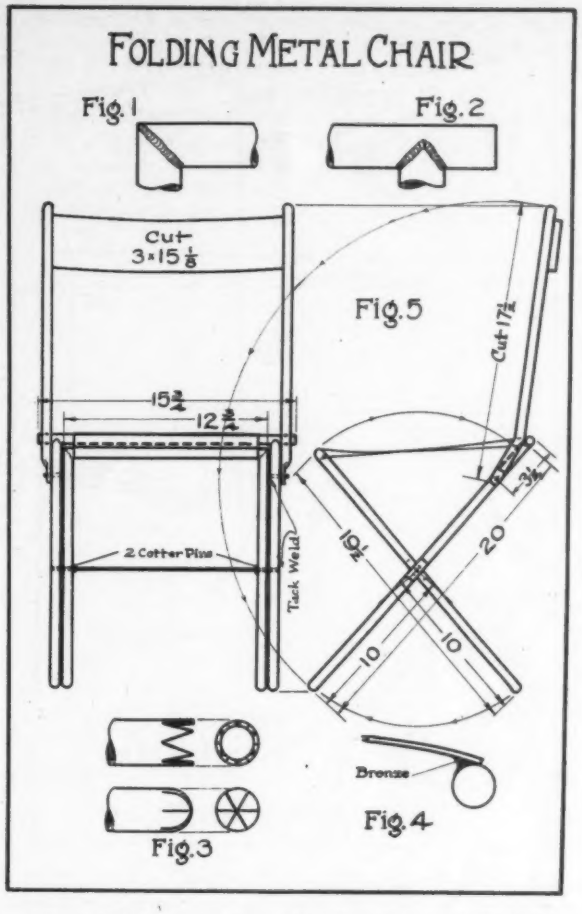
Procedure:

Cut the tubing to the proper lengths, using a hack saw, or a cutting torch with a small tip if pipe is used. Cutting all corners to the proper angles for joints indicated in Figures 1 and 2.

Weld the right angles first, forming the U-shaped front piece of the chair.

Next, weld the T joints on the rear piece. The two U shaped pieces should then be notched with a hack saw as shown in Figure 3 for the rounded ends which form the feet of the chair.





After notching the ends and bending them as indicated in Figure 3 they should be welded as smoothly as possible. A very neat job can be done if a little care is exercised.

The ends of the two pieces forming the uprights for the back should then be rounded in the same manner.

The back crosspiece should be bent to a slight curve, and then tack-welded to the two uprights, after which it can be bronze-welded, as shown in Figure 4. Care should be exercised not to heat the metal in bronze welding beyond a cherry-red heat.

The ends of the vertical pieces of the back can now be heated and flattened out as shown in Figure 5.

Next drill the holes for the ¼-in. steel filler rod as indicated in Figure 5. Small holes should be drilled in the long piece for the cotter pins. The outer ends of this piece of the steel filler rod should be tacked at the outer ends. The short pieces of ¼-in. steel filler rod used for pivots for the back, also should be tacked in place.

Now the back can be bent to the desired angle.

The entire chair should then be smoothed off with emery cloth, and lacquered the color desired. A deep green is quite appropriate for this kind of project.

The canvas seat should then be put on, thus finishing the chair.

A TOY WHEELBARROW

C. Anthony Van Kammen, Grand Rapids, Michigan

A woodwork instructor can never have too great a variety of good toys from which the boys may make a selection. The wheelbarrow presented here is quite a large and showy piece of work, yet it is not difficult for a 7th-grader to make. When completed it makes a worth-while gift for a birthday present or for the Christmas season. As shown in the working drawing, Figure 1, it is built just like a large wheelbarrow and has sides which are removable.

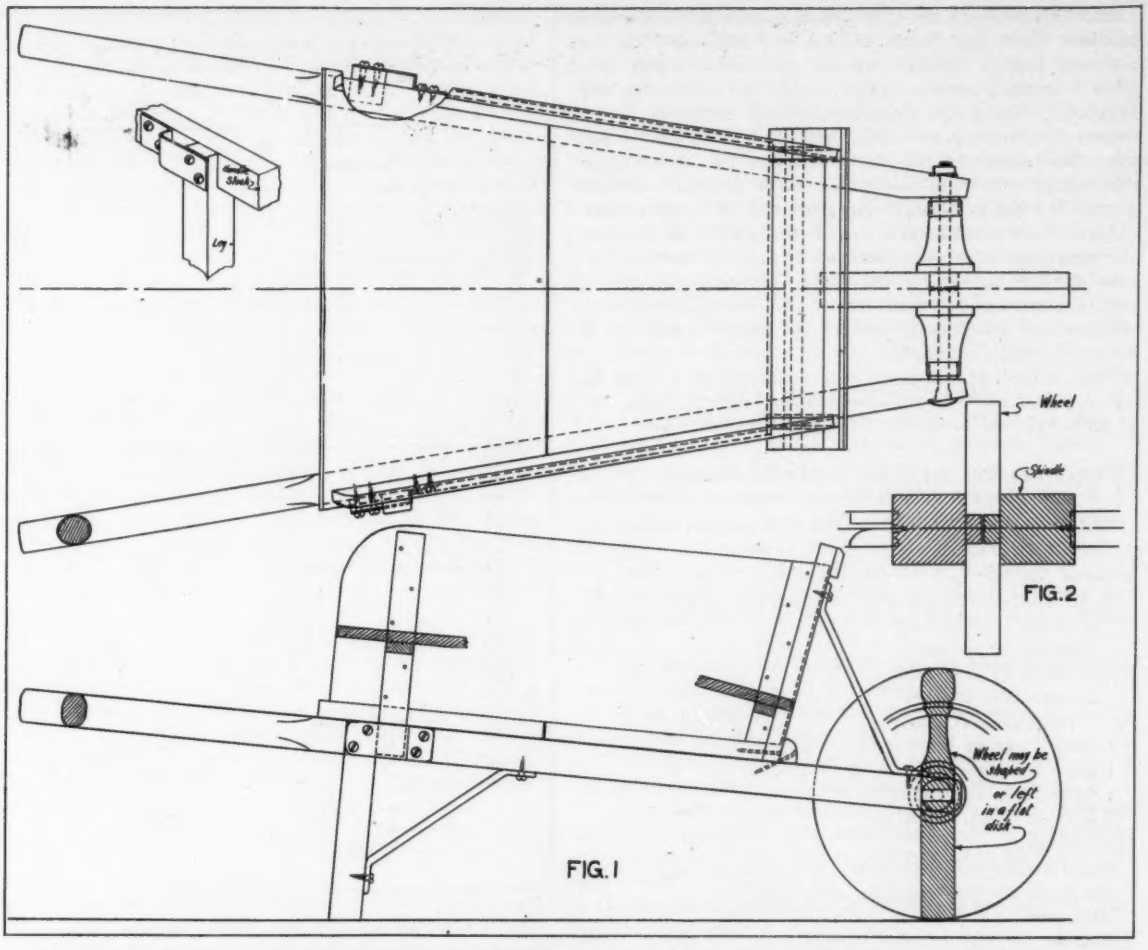


FIG. 2

FIG. 1

It is always advisable, if time permits, to have each boy make a working drawing, or at least his own stock bill from a drawing to prove that he understands what he is to do. The stock bill for the problem as shown in the working drawing follows:

Bill of Material

2 pc.	5/8 x 3/4 x 21	Gumwood	Handles
1 pc.	3/8 x 5 x 17	Gumwood	Bottom
1 pc.	3/8 x 4 7/8 x 5 1/2	Gumwood	Front, Middle Piece
2 pc.	3/8 x 1/2 x 4 7/8	Gumwood	Front, End Pieces
1 pc.	3/16 x 5/8 x 7	Gumwood	Front, Top Strip
1 pc.	3/8 x 1/2 x 7	Gumwood	Front, Base Molding
2 pc.	3/4 x 3/4 x 4 1/4	Gumwood	Legs
2 pc.	1/4 x 4 x 10 1/2	Gumwood	Sides
2 pc.	1/4 x 1/2 x 4 1/8	Gumwood	Front Cleats on Sides
2 pc.	1/4 x 5/8 x 5	Gumwood	Back Cleats on Sides
1 pc.	3/4 x 5 1/2 x 5 1/2	Hard Maple	Wheel
1 pc.	1 1/4 x 1 1/4 x 3 3/4	Hard Maple	Axle
4 pc.	No. 9 galvanized wire 5 in. long.		
2 pc.	No. 24 gauge sheet metal 2 by 3/4 in.		
1	carriage bolt 5 1/2 by 1/4 in.		

Hard maple is used for the wheel and axle. This is the only difficult part of the job to construct, and requires the use of a band saw and lathe. Saw the wheel disk slightly larger than the finished wheel to allow for turning. If the wheel is to be left as a perfectly flat disk, it should be planed before it is

sawed to shape. When shaped at the lathe the planing is not necessary. Bore the axle hole at the center of the wheel. This should be done absolutely at right angles to the face of the wheel. It is advisable to use a special jig or a drill press for accuracy. Since the wheel stock is too thin to turn between centers, and screw holes would mar the face, a special two-piece spindle is used. The spindle is made of one piece and has square shoulders cut at the center to a dowel pin calipered for a press fit in the wheel axle hole. When turned to proper size, the spindle is sawed in two at the dowel, so that a small section will project and fit into the wheel hole from each side. (Fig. 2.) The assembled spindle, with the wheel disk in the center, is then placed in the lathe where the wheel may be shaped as desired. Have the lathe turn quite rapidly and feed the turning tools into the wood very cautiously. Only scraping tools should be used.

The axles are turned between centers, and like the surface of the wheel, offers an opportunity for some original designing. The important things to watch out for are: to see that each half is the same length; that the dowel ends will fit tightly in the wheel axle hole; and that the shoulders, which are glued to the faces of the wheel, are square and fit accurately. As each section of the axle must have a ¼-in. hole bored entirely through it, on its central axis, it is suggested that a hole be bored through the length of the stock first. A piece of ¼-in. dowel rod the length of the stock is then used for a filler. Drill a ⅛-in. hole in the exact center of the dowel ends for the lathe centers, and the axle stock is ready for turning. Brass ferrules are desirable on each outer end of the axle and are made from seamless brass tubing sawed into proper lengths with a hack saw. The ends of the axles, of course, must be turned to exactly fit the ferrule. Caliper everything carefully, and if correct, remove the axle from the lathe and saw to length. Glue the axles to the wheel and when dry, drive on the ferrules. The wheel is now ready for the paint.

The body of the wheelbarrow is quite simple to assemble. Shape the two handles with a spokeshave and sandpaper, after which cut the other ends at an angle as required. Lay off and bore the bolt holes in each piece. These should be at right angles to the inside faces. Cut the stock into pieces for the bottom. Be sure to remove all mill marks before nailing to the handle stock. See that the wheel will fit at the front end and that the front edge of the bottom piece is beveled. Study the working drawing. Assemble the front with the two slots to receive the sides. Nail it firmly to the bottom against the beveled edge and strengthen it with the molding at the bottom and with the two brackets, on each side, made of No. 9 galvanized wire.

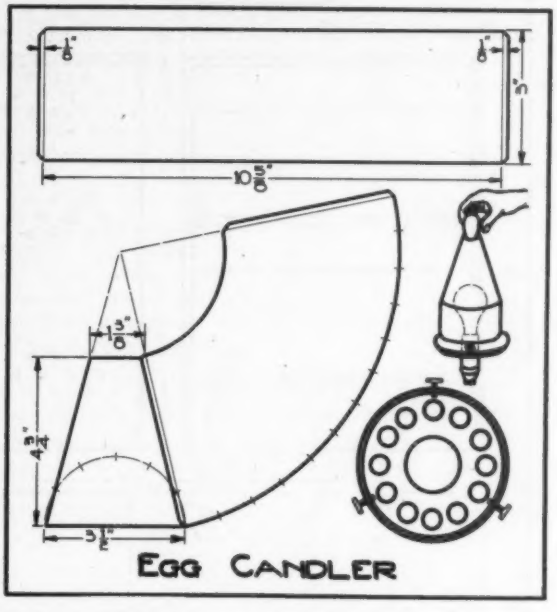
Saw the two legs to length and notch them to fit under the handle stock. Note that the notch is cut across at right angles, but that the bottom end of the leg is cut at an angle. From pieces of scrap sheet metal cut the two strips to fit over the leg and against the handle stock to hold the sides in place. See the working drawing and supplementary sketch. Drill the screw holes and fasten them and the legs in place. (Fig. 3.) Make the two wire brackets for bracing each leg and the wheelbarrow is ready to paint. Figure A shows a group of boys painting their work.

Red or green is suggested as a suitable color. Either paint or lacquer may be used, but the latter is recommended because it drys immediately and the work can be put away. A stencil, with the name of the future owner to whom the toy is to be given, may be cut from heavy paper. This name, in a bright color, such as yellow or white, may then be stenciled on the removable sides. The wheel may be painted red if the body is green or vice versa.

EGG CANDLER

John McGrath, Batavia High School, Batavia, New York

It is often necessary for the teacher to develop a project of interest to the boy who lives on a farm. With this in mind, an egg candler has been introduced into our seventh-grade general-shop course for the pupil who has need for one.



This project, although simple in construction, is very useful. It can be used on any lamp in the home or on a specially made base.

The egg candler is made of IX bright tin and a Uno 3½ in. shade holder.

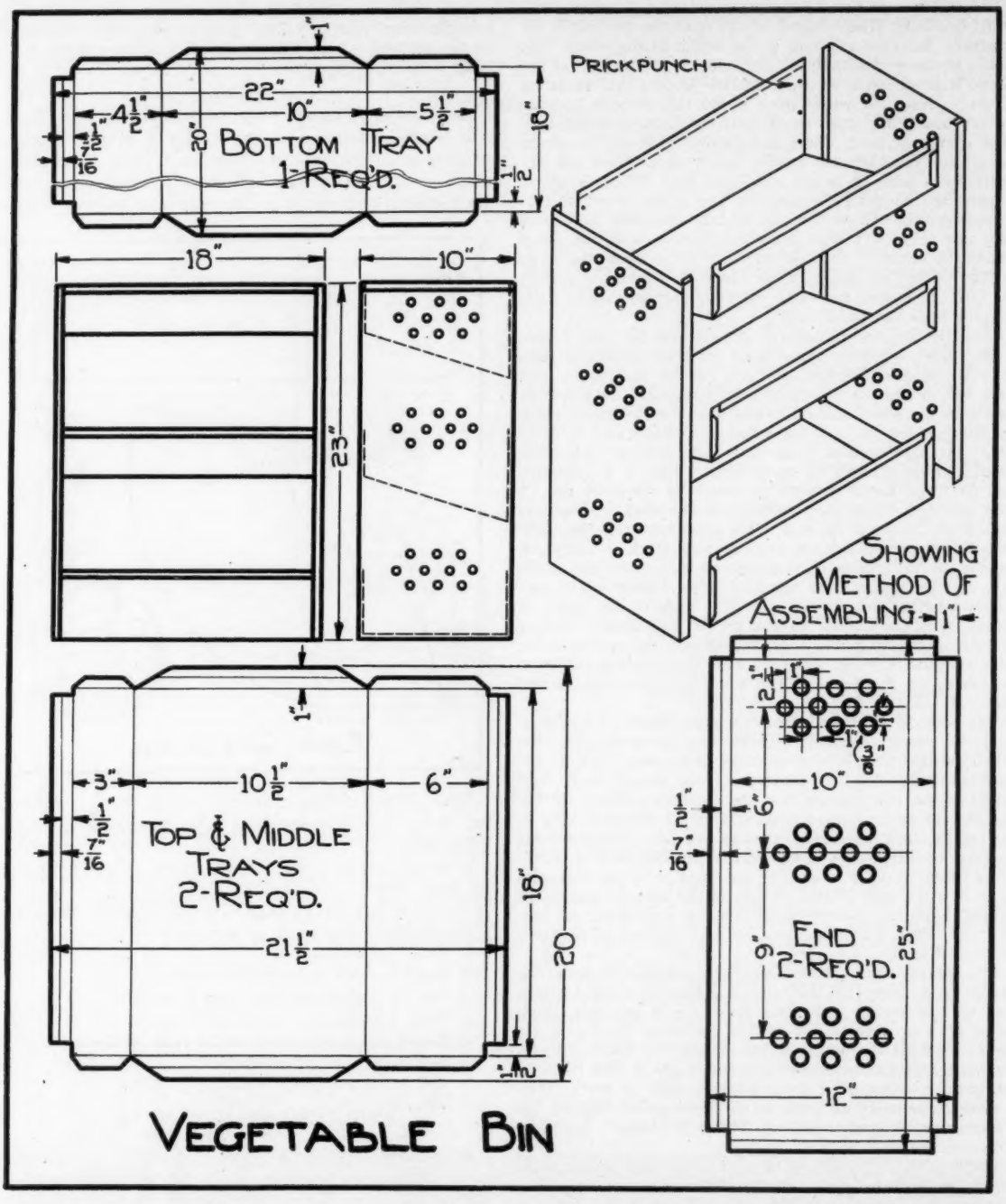
These are the various steps as followed by the pupils.

1. Develop the patterns of the project.
2. Trace patterns on tin.
3. Cut the stock and clip the corners.
4. Set the folding machine for a ⅛-in. lock.
5. Form the shapes.
6. Finish the lock seams with a hand groover.
7. Solder the two parts together.
8. Fasten on the shade holder.

WROUGHT-IRON CURTAIN RODS

A. J. Schara, Froebel Shop, Gary, Indiana

We find in most of the larger high schools, well-equipped forge shops which are being used to a great extent by junior-high-school boys. The problem which confronts the forge-shop instructor is to find projects which can be made by the student and which will be of value to him when finished.



We find that the woodworking shops and others have, through their long periods of existence, accumulated a large number of these projects, and it is not so easy to find projects for the forge shop that would be of some value to the student.

The curtain rod illustrated herewith is being used to a great extent, and they are quite expensive when purchased at the store. They can, however, be readily made by the beginning student, and besides being very attractive, are quite inexpensive.

VEGETABLE BIN

Dean Johnson, High School, Gardner, Massachusetts

This project possesses some unique joints and practical folds which can be used in other box or square constructions in sheet-metal work.

The bin can be made quickly and successfully by a beginner in sheet metal. Even at the start the boy can make a big and interesting project which at the same time is very practical and useful in the home. Of course, this project may be neither new nor original except in the type of construction. Not only is the construction very simple, but the project is so designed that a minimum amount of sheet metal is used.

Analysis of Procedure

Stock — 26-gauge black iron.

Ends

1. Take a piece of black iron just large enough to lay out the end. *Choose one straight edge* as a working edge and squaring from this, lay out one end. Use a big square and a scratch awl to *mark* the folds and cuts. (Do not cut or fold)
2. Show the instructor your layout.

SHEET METAL

D. Johnson, Instr.

Project and No._____

Drawing or Sketch Rank_____

Machines and Tools Used	For	Operation

Joints--(Sketches help)

Finishing Process--Paints and Varnishes, etc.
How applied

Materials Used	For	Part	Amount	Cost

$_____

10% Overhead $_____

Total $_____

REPORT BLANK

3. If it is satisfactory, cut it out with squaring shears or tin snips.

4. Now use this end as a pattern for the opposite end. Cut out the second end piece.

5. Fold ends on bar folder. Show the instructor how you are going to fold it first.

6. Mark out centers for the ventilating holes in the ends.

7. Show your work to the instructor, then punch or drill the holes.

Shelves (Top and Middle)

1. Lay out one of these according to the blue print.

2. Show the layout to the instructor. (Notice that the shelf is wider than the width of the side in order to allow for slant.)

3. Cut out the shelf if your layout has been approved by the instructor.

4. Use the first one as a pattern for making the second one.

5. *Fold* the edges; first showing the instructor how you are going to do it.

6. Make the folds for the front and back of the shelf on the cornice brake. Show the instructor first how you are going to do this. *Note*: Fold so double hems are on the outside of the front and back.

Bottom

1. Lay out.

2. Show the work to the instructor. Then cut out the blank.

3. Fold the edges on the *bar folder*.

4. Fold up the front and back of the bottom on the cornice brake.

Assembly

1. It may be necessary to open up runs of the slide joints somewhat with a screw driver.

2. Slide the bottom into place first.

3. Then slide the middle shelf into the approximate position starting with the back side first.

4. Then the top shelf. Notice that the bottom of each shelf is supposed to slant.

5. Now the middle shelf can be set. This should be spaced evenly from the top and bottom shelves or trays.

6. Prickpunch to hold them in position.

Finishing

1. Wash with vinegar or acetic acid, and allow to dry.

2. Then apply a medium enamel, by that is meant an enamel with quite a lot of body so as to cover without a flat undercoat. This can be brushed on or sprayed.

3. Let dry for 24 hours.

4. If the enamel has covered well and there are no runs in it, the bin may be considered finished.

5. However, if it requires more enamel, sand lightly with 00 sandpaper and apply another coat of enamel.

6. Get a report blank from the instructor and make your report on the job, including estimate of the cost, machines and tools used on the various operations, etc.

Questions

1. What tools do you use to mark the center for drilling or punching holes?

2. How can you reënforce an edge of metal other than wiring?

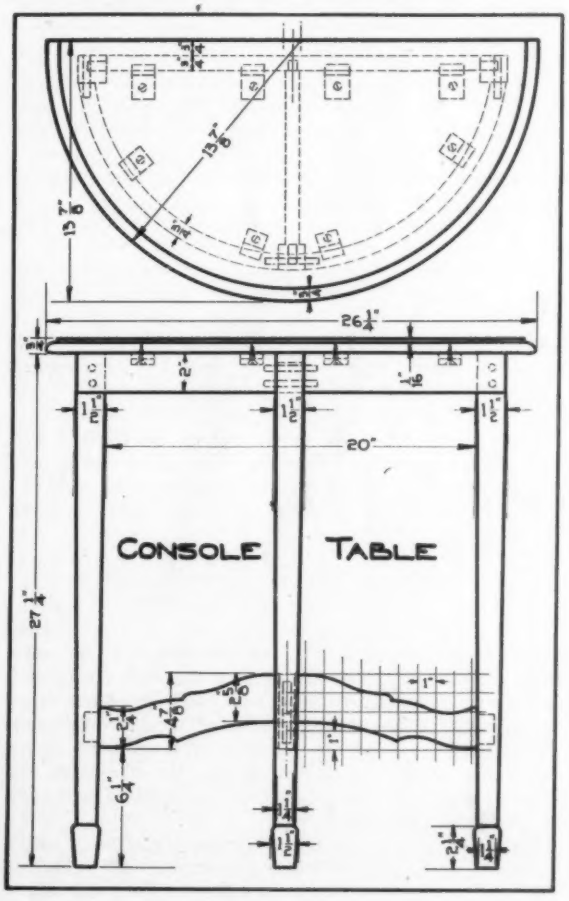
3. What method is used at times in sheet-metal work to keep metal parts from slipping?

4. What preparation is made before finishing sheet metal for inside work? Outside?

CONSOLE TABLE

L. A. Herr, Senior High School, St. Petersburg, Florida

The console table is a suitable project for shops which are equipped with power machines. The one shown is also appropriate for the shop in which the work must be done entirely by hand tools. The operations are not beyond those often performed successfully by eighth-grade boys.



In shaping the legs, first square them to 1½ in. in size. Then saw a kerf ⅛ in. deep around each leg at the top of the spade foot. Chisel off the wood above the kerf for a distance of 3 or 4 in. From this point to the top of the posts the tapering may be easily done with a plane. Next, round the upper part of the spades with a chisel, then plane the spades to the desired taper.

The chamfered edge on the top of the table can be made as follows:

After the curve of the top has been cut and made smooth, draw a line with the marking gauge ⅝ in. from the edge. For this work the gauge point should be sharp so that it will cut a clean line. It will be wise to remove the gauge spur and sharpen it especially for this job. Next, deepen the line by carefully following it with a sharp knife point. The wood next to this line must be removed with a chisel. Do this after cutting the outer edge of the chamfer with a plane and spokeshave. Have the chisel sharp and proceed slowly and little difficulty will be encountered in making a clean-cut fillet. The assembly of the table presents no peculiar difficulties.

FINISHING KITCHEN-TABLE TOPS

V. C. Darby, Cedar Rapids, Iowa

It has always been a difficult problem to properly finish bread boards, cutting boards, kitchen-table tops, and other wood surfaces that come in direct contact with the food. It is a common practice to allow such work to go unfinished.

The wood in these projects, however, needs protection, as it is constantly subject to extremes of temperature and is frequently washed. In time, therefore, the glue joints will loosen, unsightly and insanitary checking, cracking, and warping will take place.

Sanitation does not permit using any of the usual paints, varnishes, or lacquers, as these preparations will impart to the wood an unpleasant taste or odor.

For finishing and protecting work of this sort, I have repeatedly used mineral oil (liquid paraffine), of the kind sold by the druggist for medical use. The results have been uniformly satisfactory.

This oil penetrates the wood deeply and thoroughly, and is not greasy, and as it is tasteless and odorless, it does not injure the food which comes in contact with it. Then, too, as this type of oil is primarily intended for internal medical use, it is pasteurized, and so, of course, is entirely sanitary.

Two or three liberal coats (depending upon the condition of the wood) should be applied and rubbed well into the wood, and additional coats should be applied as needed. Having both the wood and oil warm will help toward deeper penetration.

This treatment is easily applied, and it will make a piece of wood practically waterproof, and thereby eliminate the twisting and warping so common to this class of woodwork.

THE MODEL AIRCRAFT CLUB

Harold Stiles, High School, Nogales, Arizona

The Model Aircraft Club at our high school was organized for the purpose of stimulating an interest in aviation. The work of building the models proved a very delightful pastime.

The meetings of the club are held twice a week, and a nominal fee of 5 cents per week is collected from each member every second meeting. The money thus obtained is used to buy prizes for the monthly contests.

New members must pay a 25-cent initiation fee and they must build a model which will fly at least 10 seconds.

The officers of the club consist of a president, vice-president, secretary, treasurer, and the stock clerk. Each holds office for a period of two months, and for as many terms as elected.

MODEL AIRCRAFT CLUB

Contests are open to the public and are conducted according to the rules formulated by the members of the club.

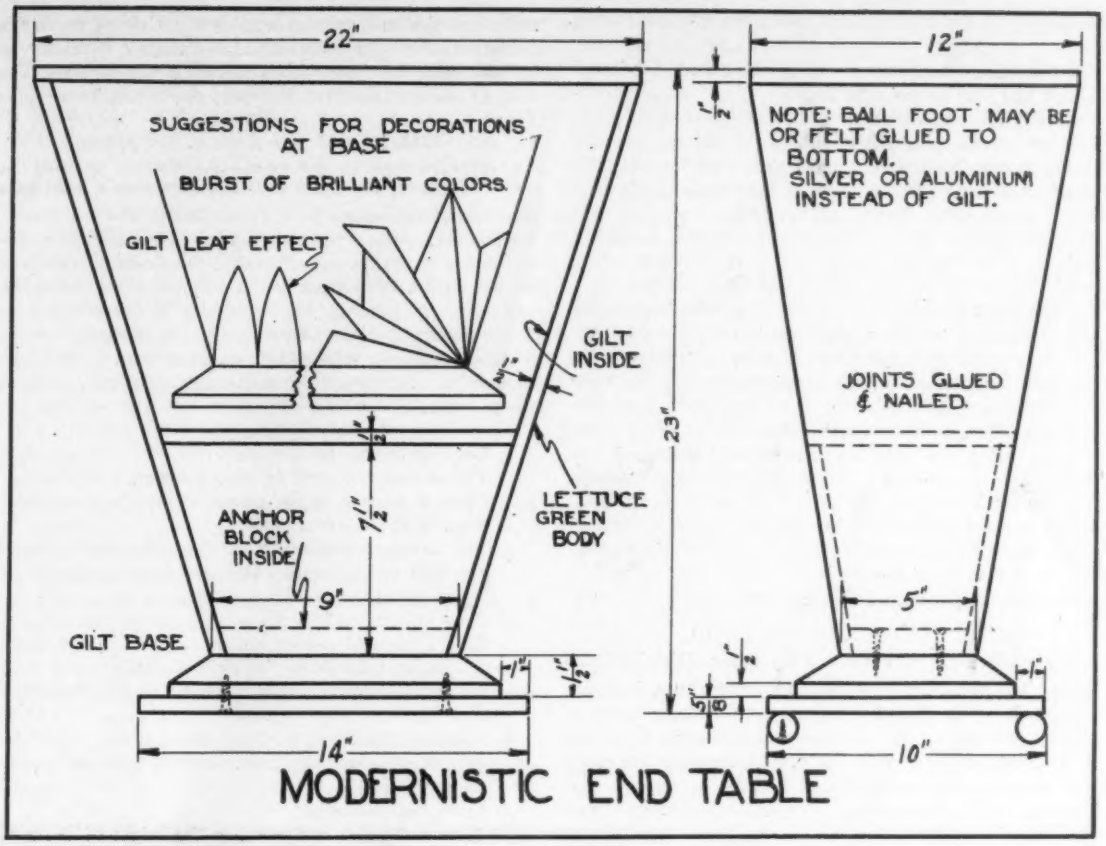
Members are classified and rated as follows:

Mechanic. A member who has constructed a model airplane which is capable of making a flight of 15 seconds or more.

Cadet. A member, who in addition to fulfilling the foregoing requirements, constructs a model airplane capable of flying 250 ft. or remaining in the air for 25 seconds.

Pilot. A member, who has satisfied the mechanic and cadet requirements, and:

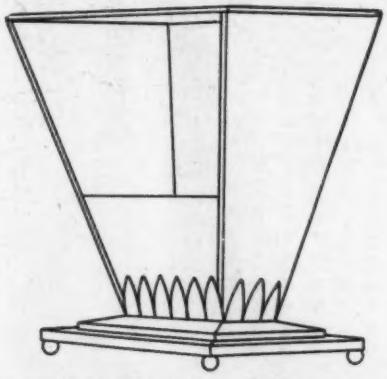
1. Passes a satisfactory examination on the principles of model making and flying.
2. Designs and makes a model airplane which will fly at least 500 ft. or remain 50 seconds in the air.
3. Has satisfactorily served as an officer of the club.



MODERNISTIC END TABLE

R. M. Hammes, Abraham Lincoln High School, Council Bluffs, Iowa

This end table is new and different, and will prove interesting to many boys. The project may be utilized as a pre-



liminary or fill-in job for advanced work, or it may be made in higher classes of elementary woodwork.

The principle point to be observed is the proportioning of parts. The piece will fit in with period types if the color scheme of the table harmonizes with its general surroundings. The suggested coloring fits in with most schemes and proves quite attractive. Lacquer was used because of its quick drying, a qualification desirable in the finishing of a preliminary or fill-in job.

MACHINIST JACKSCREW

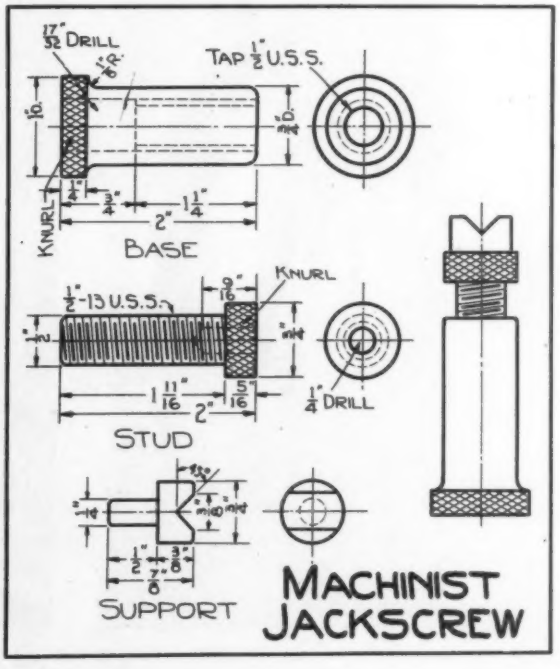
A. B. Grayshon, Cooke Junior High School, Philadelphia, Pennsylvania

A jackscrew is an appliance used by a machinist to support work on which he is engaged in a rigid position relative to the table of a machine.

The jackscrew is a project which involves several different operations, and does not require a great deal of time to complete by chucking or on centers.

Materials required:

1 piece cold-rolled steel ⅝ in. diam. by 1 in. long
1 piece cold-rolled steel ¾ in. diam. by 2⅛ in. long
1 piece cold-rolled steel ⅝ in. diam. by 1 in. long



Operations

Base

1. Cut the stock
2. Chuck and face to the right length
3. Turn down the diameter
4. File the turned surface smooth
5. Rechuck and drill for the tapped hole
6. Counter drill the 17/32-in. hole to the proper depth
7. Knurl coarse or medium
8. Tap the hole
9. Polish

Screw

1. Cut the stock
2. Chuck and face to the required length
3. Chuck for turning the smaller diameter
4. Rechuck for drilling the hole in one end
5. Knurl the same as the base
6. File the edges in the machine
7. Thread with stock and die or on the lathe if desired

Support

1. Cut the stock
2. Chuck and face to the length required
3. File smooth in the machine
4. Secure in a vise and file the V

Assemble all the pieces and oil the parts

MODERNISTIC FLOOR LAMP

J. I. Sowers, Director of Vocational Education, Miami, Florida

When the art moderne, or modernistic furniture, began to be designed in the United States, it soon took on many of the characteristics of our skyscraper architecture. With this idea in mind, the floor lamp illustrated herewith was made in the Washington School, Miami, Florida.

The basis of the design was the new Dade County Courthouse located at Miami. A large picture of the building was tacked on the wall and the lamp grew up as the teacher and pupil conceived the adaption. The similarity is readily seen by comparing the lamp with a picture of the building. There was no drawing used for this project. It just grew up like Topsy.

EMBOSSING ON A PLATEN PRESS

An Operation Sheet for the Advanced Vocational Printing Class
C. Cryderman, The Stout Institute, Menomonie, Wisconsin

Operation: Embossing on a Platen Press.

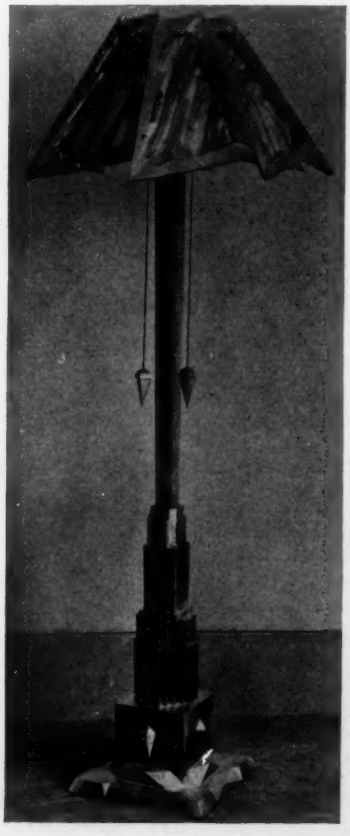
Application: Many jobs of printing, such as fancy covers and dance programs, are embossed. "Embossing" means that certain letters or designs are raised above the surrounding surface of the paper by the impression of matched dies.

Tools and Equipment: Platen press, die, and gauge pins.

Materials: Stock to be embossed, strawboard (a piece large enough for the tympan), embossing compound, glue, and tissue paper.

Procedure:

1. Lock up the die in the chase.
   This is done the same as though it were a type form. Place it as near to the center of the chase as possible.
2. Remove rollers from press.
   The rollers are removed from the press because they are not used and it would cause unnecessary wear on them if they were left on.
3. Place tympan on platen.
   Glue a piece of strawboard on the platen as a tympan. A tympan held on by the bails is liable to slip, and in die work there must be absolute match between the dies when the press is closed.
4. Take an impression on the tympan.
   Ink the die with the finger or with a brayer and take an impression.
5. Make the counter die.
   Place embossing compound to the height of about 1/32



THE FLOOR LAMP AND THE DADE COUNTY COURTHOUSE

in. over the impression and cover it with a thin piece of proof paper, glossy side up. Smooth out the proof paper and take another impression. Leave the press in the closed position for about a minute.

6. Trim edges of die formed.
   Trim the edges of the die with a knife, tapering them to meet the tympan. Be careful not to injure that part of the die which is in register with the female die. Leave press stand for about half an hour to allow the die compound to set.
7. Register job to be embossed.
   Register the job the same as any other job of registry and run the job through.

Caution: Never remove the chase from the press after the male die is once made. If heavy stock is being used, it is best to use two or more sheets of proof paper over the compound when the die is being made. The more sheets used, the less distinct become the raised portions.

Questions:

1. What is embossing?
2. Why should the die be placed near the center of the chase?
3. Why is the tympan glued to the platen?
4. Which is the female die? The male?
5. If printing is to be done should it be done before or after the job is embossed?

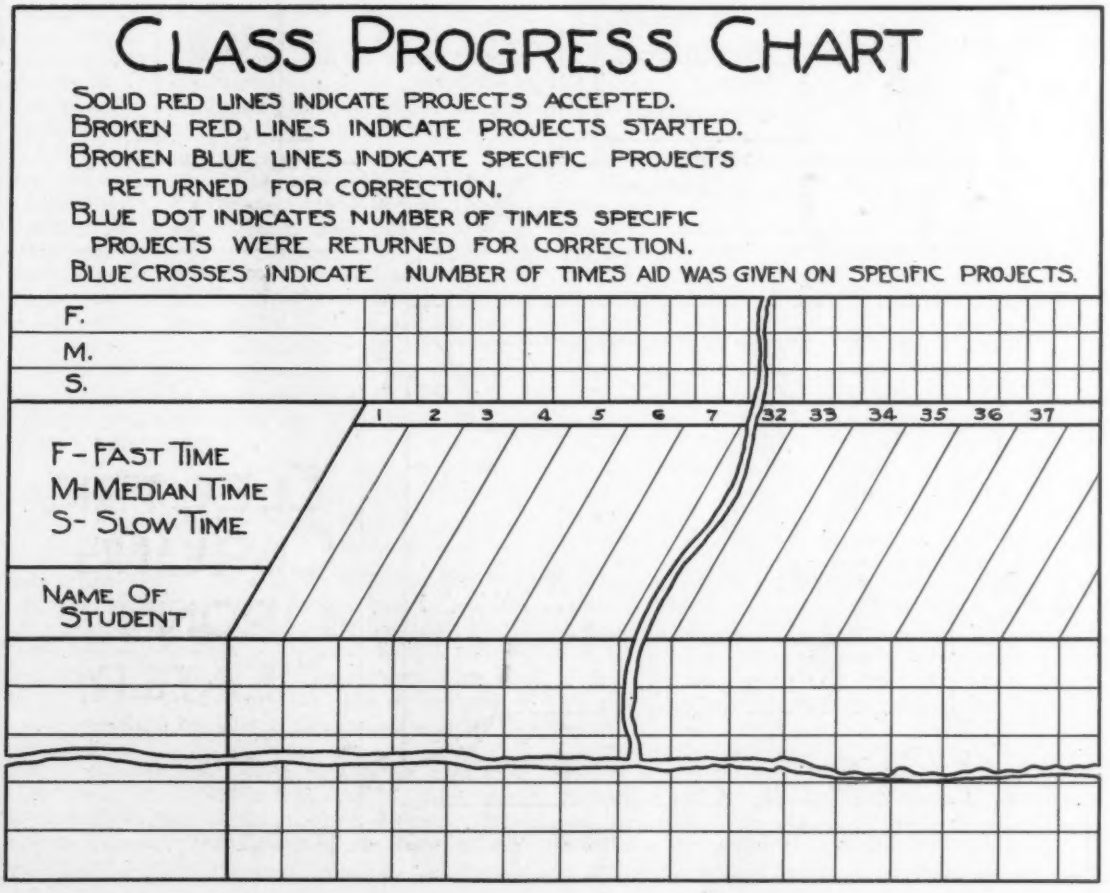
STUDENT PROGRESS CHART

Ralph T. Northrup, Arthur Hill Trade School, Saginaw, Michigan

In order to be practical as well as efficient, a trade school today must adopt methods of work, procedures, charts, etc., that are closely related to the ones found in industry. Today, almost every large manufacturing concern has its production chart or blackboard which shows the amount of work to be done, and the time required in performing the various operations.

The following chart devised by the writer has a fivefold purpose in the classroom. First, it acts as a constant reminder to the student of his present progress as compared with the amount that has to be done in order to satisfactorily complete the course. Second, it gives the trade student a graphical account of his progress from an individual standpoint. Third, it gives the student information regarding the *fast, median,* and *slow* time that other students have made on the same projects, and after a brief explanation regarding the value of producing things in a short length of time, the students are stimulated and show great delight when the fast time is improved. Special grades should be given for the reducing of the fast time. Fourth, the pupil is informed of his progress as compared with the other members of his class, and he is able to evaluate his success as a tradesman by comparing his record with the best that appears on the chart. Fifth, it gives the teacher a running account of each pupil's progress and shows where too much time is being spent with one or two pupils thus making for a better distribution of time.

Students watch the results as they appear on the chart day after day and often enter into arguments with each other when trying to explain why they did or did not do well on a given project. The blank spaces at the left, under the title "Name of Student" is filled out after the enrollment has been completed. The names of the various projects which the teacher wishes to include in the semester's work, are written in the columns numbered 1, 2, 3, etc. The double spaces marked F, M, S are for the three values of time attained on each project for the previous semester's work, and the


CLASS PROGRESS CHART
SOLID RED LINES INDICATE PROJECTS ACCEPTED.
BROKEN RED LINES INDICATE PROJECTS STARTED.
BROKEN BLUE LINES INDICATE SPECIFIC PROJECTS RETURNED FOR CORRECTION.
BLUE DOT INDICATES NUMBER OF TIMES SPECIFIC PROJECTS WERE RETURNED FOR CORRECTION.
BLUE CROSSES INDICATE NUMBER OF TIMES AID WAS GIVEN ON SPECIFIC PROJECTS.
F.
M.
S.
1 2 3 4 5 6 7 32 33 34 35 36 37
F- FAST TIME
M- MEDIAN TIME
S- SLOW TIME
NAME OF STUDENT

time set for the work on the same projects for the present semester.

ELECTRIC CURLING-IRON HEATER

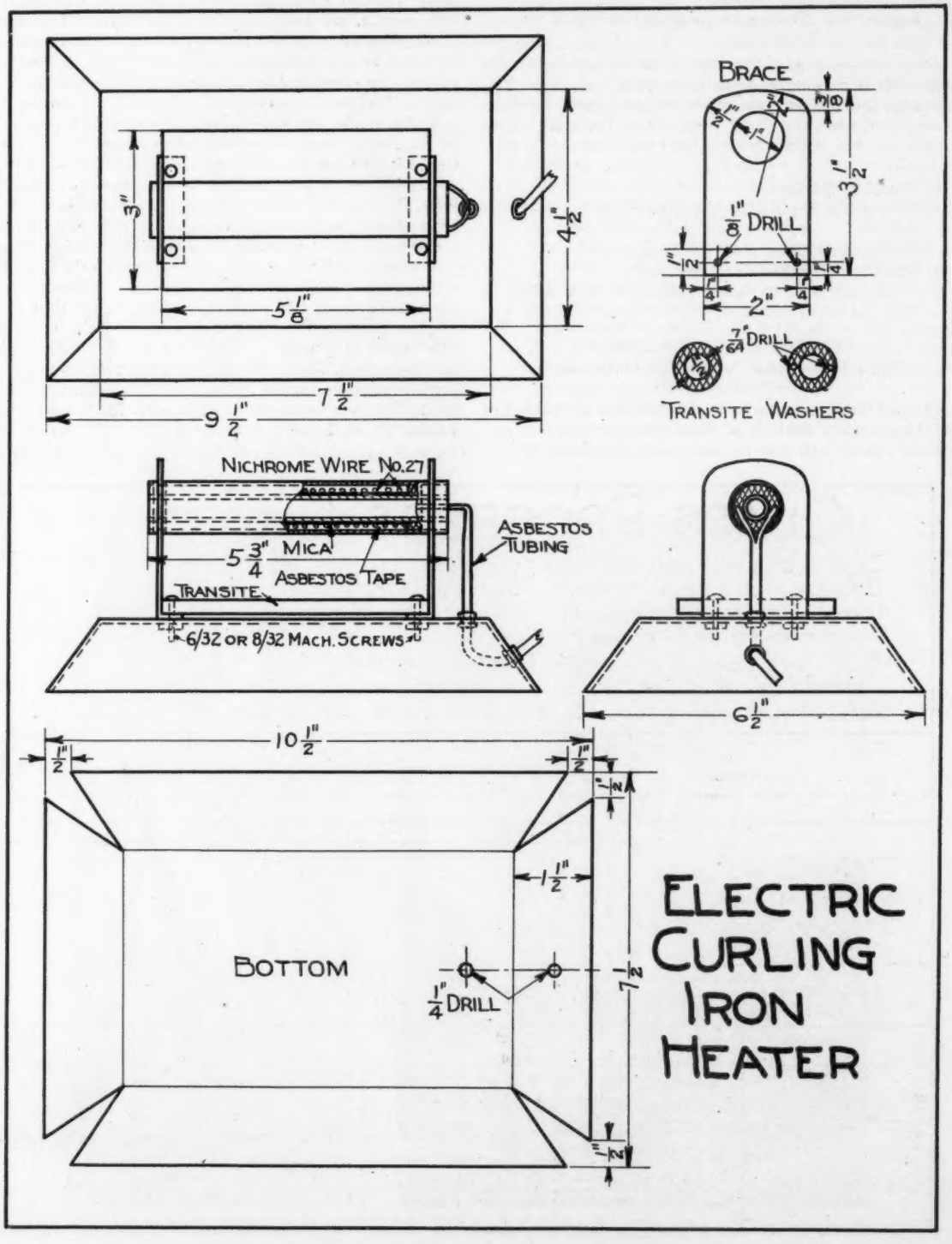
R. B. Farr, South Junior High School, Everett, Washington

A very interesting project, with the boys in my shop classes is the electric curling-iron heater.

The bottom is made out of a piece of brass 7½ by 10½-in. No. 20 gauge, half-hard brass.

Lay out the corners of the bottom as shown. Drill the two ¼-in. holes for No. 0 brass gromets. These make a smooth, neat-appearing hole for the wires to pass down and out from the large brass tube to the light socket or wall outlet. After cutting out the triangular corner pieces, bend the sides to the proper angle and solder them. Then scrape off all surplus solder.

Cut two braces from the same brass that is used for the base. Drill the two ⅛-in. holes and then bend the bottom of the braces at right angles on the bar folder, in a vise, or between two blocks. Use a 1-in. hollow punch and a lead plate for cutting the 1-in. hole in the center. A large drill



may be used also for this purpose. Then remove all sharp corners with a file.

A piece of transite ¼ by 3 by 5⅛ in. may be used to protect the table top from blistering or burning. Bolt down the transite and the braces with 6–32 or 8–32 brass machine screws.

Cut one piece of brass tubing 5¾ in. long and 1 in. outside diameter. Cut another brass pipe 5¾ in. by ½ in. diameter.

Cut two pieces of transite and make washers that will fit over the outside of the ½-in. pipe and inside the 1-in. pipe. Through one of the washers drill two 7/64 in. holes for the ends of the nichrome wire.

Before the brass parts are assembled they should be buffed on the buffing wheel with tripoli and snow white.

To wind the heating element, first wrap the ½-in. brass pipe with sheet mica at the space, between the transite washers. Tie the ends or wrap friction tape on the ends until you are ready. Cut about 20 ft. of No. 27 nichrome wire for the coil and about the same amount of No. 20 bare copper wire for the spacer wire. If you have a machine lathe the ½-in. brass pipe may be placed in a chuck for winding, or it may be fastened into a machinist's vise and wound by hand. By this time the mica sheet that was taped on the ½-in. brass pipe should have the shape of the pipe so that it will not be so hard to handle. Take the mica sheet off and wrap just one layer around the pipe and put one end of the wire between this layer and the next layer of mica, and then continue to wrap the rest of the mica sheet around it. This method is used in order to have both ends of the coil come out the same end of the big pipe. Now start winding on the rest of the wire, winding both the nichrome and the copper wire at the same time. This winding should just about fill the space between the transite washers. Run the two ends of the nichrome wire through the transite washers with the small holes and fasten them securely. After the ends of the nichrome are held fast so that the nichrome will not unwind take the copper wire off. If this nichrome wire should unwind, it will have to be wound over again, as the loops of the nichrome are not to touch each other or any other metal. If it should touch, it will cause a short circuit.

Wrap some asbestos tape or asbestos cloth around the nichrome coil and tie it secure with strands of wire. This also helps to hold the nichrome wire in place. The asbestos also holds the heat inside where it is needed. The ends of the nichrome should be long enough to reach through the upper hole in the base and to make a splice on some heater cord.

Tie the asbestos tubing inside the large pipe so that it will not come out. If the person making the heater finds it very hard to use the mica sheets, a retort cement may be used which also will be found quite satisfactory.

A separable plug is put on the end of the heater cord and the heater is ready for use.

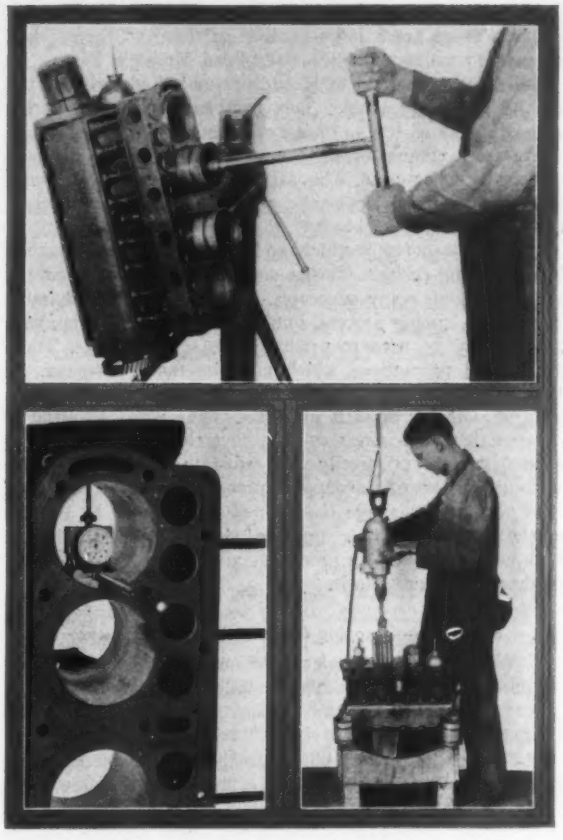
TYPICAL JOB SHEET FOR THE AUTO SHOP

Ray F. Kuns, Cincinnati, Ohio

Reconditioning Ford Model T Cylinder Block

Owing to the fact that the rings are expanded against the cylinder walls with considerable force, there is always a certain amount of ring wear evident in a used engine. This may vary from a very slight amount up to .020 of an inch. Another cause of cylinder wear is the inside thrust or pressure of the piston. This usually wears the cylinder into what is termed an egg shape, the longest diameter being across the cylinder block.

Cylinders frequently wear tapered, the ring wear being more severe at the top than at the bottom. Another feature which leaves the cylinder wall in bad condition is the scoring of the cylinder or pistons. Scoring may be due to a number of causes, the most frequent one being the lack of proper grade



TOP—FIG. 1; LEFT HAND—FIG. 2; RIGHT—FIG. 3

or amount of lubricating oil. Sometimes scoring results from the accumulation of carbon, which gets between the piston and the cylinder wall. It then becomes overheated and acts as an abrasive. Rings which have become broken or are not of proper grade for the block in which they are used, sometimes result in scored cylinder walls. A cylinder may be scored just as soon as the engine is put into use if the piston and rings have been fitted too tightly and if the lubrication is not quite up to par. Extreme care should always be used to see that the rings are fitted so that they have the proper end clearance. If they do not have this clearance, the heat causes them to expand and forces them into the side of the cylinder wall thus producing severe scoring.

Piston pins sometimes work loose and the result is a piston-pin score in the cylinder wall. In the case of the Ford Model T care should be used to see that the piston-pin bushings are pressed in a sufficient distance to prevent the end of the piston pin protruding beyond the diameter of the piston, thus scoring the cylinder wall.

There are a number of methods of reconditioning cylinders. The original method of boring cylinders was to use a boring machine or a lathe. This method has long since become obsolete in automobile factories. There are a number of machines on the market which are used to rebore cylinders, in the repair shops. The standardized practice for Ford Model T cylinders is to use the K. R. Wilson Reboring Machine which will bore cylinders to any standard oversize desired.

Where the school shop is equipped with such a reboring machine it should be used for reconditioning cylinders. Where the shop is not so equipped, it may be that it is equipped with some form of hone. This is a standardized practice the world over for reconditioning cylinders in any type of car, being perhaps the most popular of all methods.

Another practice of reconditioning cylinders is to use a reamer. There are a large number of these on the market, adapted to use in the case of the Ford Model T Block.

Still another method of reconditioning cylinders is the use of the grinding machine. This is a large machine, costing approximately $3,500 and not available in most school shops. There are a number of smaller machines which are designed to bore, ream or grind. The instructor in charge of the work will have to determine what method he will use in reconditioning Ford cylinder blocks.

One of the oldest methods and one available to any shop is the lapping process. This is condemned in many quarters, yet it still finds many advocates. As a rule it is not advisable to use the lapping process, but if no other process is available it may be used to produce satisfactory results. There are certain precautions which must be taken, however. At best it should not be depended upon to remove more than .001 or .002 of an inch of metal. Thus when a piston is ordered that is so much oversize that there is not sufficient clearance, it is practically impossible to reduce the piston without the use of the lapping process. On the other hand, it is possible to enlarge the bore of the cylinder by the use of the hone. This is the practice which should be followed, if possible. The lapping process is given here for the benefit of those who must use it.

Procedure — Lapping Cylinder Bores and Pistons

1. When lapping cylinder bores and pistons the grinding action occurs both on the cylinder wall and on the piston skirt.
2. Examine the cylinders to learn the amount of metal to be removed.
3. Secure the pistons which are to be fitted to the cylinders, trying them in the various cylinders. If they are to be fitted by lapping, they should "start."
4. If there should be one which fits before starting, provide a lap from an old piston.

Note. This may be produced by taking an old piston and sawing it along one side and across the top. One of these is seen resting on the rear of the cylinder block in Figure 1. This piston is expanded by means of a ⅛-in. pipe plug which is screwed into the crossing of the slot cut with a hack saw.

5. Provide a handle for the lapping operation by welding two pieces of ¾-in. gas pipe together. Some mechanics use two connecting rods bolted together.
6. Place a bit of fine grinding compound on a piston which is found to start. Force the piston into the bore of the cylinder by means of the handle, mounted as shown. Use a rotary motion in combination with an in-and-out motion.
7. Continue the grinding operation by means of this spiral motion until the piston can be forced the full length of the cylinder bore. Clean the piston and cylinder walls with a rag and gasoline.
8. Check the clearance of the piston by means of the feeler strip.
9. When a proper clearance has been secured, the grinding operation for that cylinder and piston is complete.
10. Proceed to grind or lap in all of the pistons. If one is found which will not enter, use the piston lap prepared, and grind out enough of the cylinder metal to allow the new piston to enter.
11. When all of the pistons have been fitted to their cylinders, the job is ready to be cleaned.
12. Remove all of the pistons and scrub them thoroughly with a stiff bristle brush and gasoline. Make very certain that they are clean inside and out. In some shops gasoline and an air spray gun is used for such work.
13. Scrub the cylinder block inside and out. If there are any points about the cylinder, such as valves or bearings, which have been in contact with the grinding compound, use extreme care to see that they are thoroughly cleaned.

Procedure — Checking up on the Bore of the Cylinder

1. The cylinder gauge illustrated in the No. 1 cylinder in Figure 2 is designed to show any inequalities in the diameter of the cylinder. As it is slid forth and back within the cylinder, the hand of the dial on the gauge records the variations in thousandths of an inch. This device is excellent for use when reconditioning cylinders by the lapping process described in the foregoing, or by the honing process which is explained in that which follows.
2. Place the gauge in the position shown and set it to zero. The dial is adjustable.
3. Run the cylinder gauge to the bottom of the cylinder, noting any variation.
4. Compress the plunger and pull the cylinder gauge.
5. Insert it ¼ turn from the position shown in Figure 2. Note the reading at this point in comparison with the original reading.
6. Pass the gauge to the bottom of the cylinder, noting the variation and recording the reading.
7. Compare the readings taken to see whether the cylinder has taper or is out of round, after which the honing may proceed.

Procedure — Honing a Cylinder to Fit Pistons

1. Secure the hone from the toolroom and set it up for a 3¾-in. cylinder bore.
2. Check the stones to see that they are in good condition and free from glaze.
3. Mount the 5/16-in. drill with spring device, as shown in Figure 3, to carry the weight of the heavy electric drill.

Note. Some shops use an old inner tube for this work.

4. Mount the hone spindle in the chuck of the drill.
5. Adjust the hone to one of the cylinders so that it is free-turning but will not fall through.
6. Provide a quantity of kerosene and an oil can.
7. Have the pistons laid out for the various cylinders.
8. Start the honing operation, remembering the dimensions and inequalities of the cylinder being worked on. If there is considerable taper, it will be necessary, of course, to start removing this first.

Note. There are several types of hones on the market. Some of these work with a spring drill and some are positive set. The positive set type is most popular in the trade since it will save considerable time where as much as .008 in. or .010 in. of metal is to be removed. The following directions apply to the positive set type of hone.

9. Set the expanding device of the hone until the electric drill is loaded down severely, that is, it has difficulty in turning under the load.
10. Apply a considerable quantity of kerosene on the stones.
11. Turn on the current and work the hone back and forth over the high spots in the cylinder until sufficient metal has been removed so that the drill starts to speed up.

Caution. Do not allow the hone to leave the cylinder bore while the drill is being used to turn it.

12. Stop the drill and readjust the expanding device. Apply more kerosene and proceed with the grinding. After grinding for a short time stop the electric drill.
13. Remove the hone from the cylinder and see that the stones are kept free of glaze. This may be done by using an old broken stone or old file. Wash the complete hone and stones in kerosene. Scrubbing with a wire brush will rid the stones of accumulation of ground material and bring out new surface.
14. Check the fit of the piston from time to time as the grinding proceeds. Use the feeler strip for this check. Always clean the cylinder bore and the piston with a rag and gasoline before checking.
15. Check the cylinder continuously for the effect of the work, noting whether the taper has been removed and whether the cylinder is being rounded up.

Caution. Do not permit the positive-set type of hone to run without a load on it. To do so causes the stones to glaze, and the cylinder block to heat up, without producing any useful results. Keep the stones clear of accumulation or glaze and force the work. A properly adjusted and cutting hone will remove .005 to .010 in. of metal in five to ten minutes actual honing.

16. Use a medium stone for grinding and finish the job with a fine stone.

17. When finishing, the drill may be allowed to speed up somewhat and the motion being up and down, the scratches which appear in the cylinder will be spiral.

18. Continue the grinding until proper clearance is secured for the pistons being fitted.

19. When honing a job, do not attempt to finish the job by lapping, but remove the metal from the cylinder with the hone until the piston has proper clearance.

Caution. The hone is a tool somewhat difficult to master. The inexperienced allow the stones to become broken or out of condition, with the result that it is impossible to do a good piece of work with them. Some instructors will allow students to take a hone and simply grind away at a cylinder block without any idea of what it is all about. A student who is unable to grasp the intricacies of the job should not be allowed to take hold of a hone on any block, whether it is desired to use the block or not. Things wrongly learned are worse than those not learned. It is very easy to ruin a block by misdirected effort with a hone. For instance, a block in fair condition, when the student starts working on it, may presently be found with a .015 to .020 in. taper. On the other hand, there is no question about the ability of the average student to learn cylinder honing.

20. After the cylinders have been honed and the pistons properly fitted, the final job is cleaning up the block and the pistons. The method suggested for the cleaning of the work after lapping is equally good in this case.

MR. ROBERT HOPPOCK GIVES VOCATIONAL GUIDANCE TALK AT SCHENECTADY

Mr. Robert Hoppock, secretary of the National Vocational Guidance Association, speaking recently before the members of the Capital District Association at Schenectady, N. Y., pointed out that of 700 dishwashers, members of a labor union, 100 had graduated from college.

Of every 1,000 boys who enter college to study engineering, said Mr. Hoppock, 600 never graduate. Sixty boys on the average enter the University of Texas each year, and only fifteen ever graduate. Of 1,000 college boys who began the study of engineering, more than one half had no idea of the work when they began their courses, and fully 80 per cent selected the course while in the secondary school.

Mr. Hoppock pointed out that vocational guidance will not do everything. It cannot tell an individual just which occupation he should enter; it cannot agree to place everyone in the right vocation. It can, however, eliminate the haphazard, hit-or-miss method of finding a job and replace it by a reliable, informative method of giving information about occupations.

BLACK FINISHED TABLE TOPS

915. Q.: I am making a library table of California white pine. I want the top to be jet black, and then I will shellac it and varnish it. Will you please tell me how to make a penetrating stain, that will make it black? Could I buy such a stain, and if so, what company makes it? — *E. C. V.*

A.: Make up a solution of 2 oz. of tannin (tannic acid) in a gallon of water. Apply and let dry. Sand smooth with a 4/0 paper. Make up another solution of copperas (iron sulphate) in water using 4 oz. per gallon. Apply to the sanded, tannin-treated surface and allow an overnight drying to deepen the color. If it is still too light, repeat the two coatings as outlined above. This should give you as deep a black as you could wish. Next, brush on a coat of high-grade 4-hour varnish on the well-dried wood, omitting any shellac coat on table work of this kind. This is necessary in order that no possibility of chipping may occur later. Let the varnish dry overnight and sand with a split 6/0 garnet finishing paper, dust off well, use a tack-rag, and recoat. Repeat the sanding, revarnishing, etc., until the desired body has been obtained. The last coat should be rubbed with FFF pumice stone, crude petroleum oil, and a felt pad. Before cleaning off the last rubbing sludge, fold up pad of cotton flannel wrung out of water, and use to carefully rub out the last part of the finish, sprinkling freely with water as the work requires. Wipe clean with fresh rags and clean up with a good oil polish. — *Ralph G. Waring.*

REMOVING AN OLD FINISH

916. Q.: I have stained a table top with a solution of half asphaltum and half gasoline. Now I want to remove this color, together with the varnish and shellac over it. Will you please tell me how I can do this? — *E. C. V.*

A.: The old finish may be readily removed with a good grade of varnish remover. Apply freely with an old brush in a one-way stroke so as to avoid breaking up the film of paraffin which acts as a blanket over the solvents and thereby forces them into the old finish instead of allowing them to dissipate into the atmosphere as will occur from excess brushing. As soon as the finish is softened it may be removed with a wide putty knife, and the latter wiped on a quarter square of old newspaper torn for the purpose. The papers should be folded and put out of harm's way as soon as used in order to prevent the possibility of spontaneous combustion which is always present with this class of work. When the top has been well cleaned, go over the surface with steel wool and denatured alcohol to get rid of all traces of varnish remover and wax. Contrary to the printed directions on the can of remover, do not use gasoline for the final clean up, this treatment simply dissolves the traces of wax, spreads it over the entire surface and thereby marks the beginning of a lot of future finish troubles. Alcohol, on the other hand, destroys all film-forming properties of wax. Let dry overnight, sand to clean white wood; bleach with a 4-oz. solution of oxalic acid if necessary, let dry and resand. Follow with whatever finish is desired. — *Ralph G. Waring.*

REFINISHING SCHOOL DESKS

918. Q.: We have about 200 school desks that must be refinished and would like suggestions as to how to proceed. Most of the tops are badly scratched and scarred and some have deep holes dug in the top or cut on the edges. What is the best method of removing the old finish? Will the portable sanders advertised in the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION remove deep scars and scratches? What material is best to use for filling holes too deep to remove with a sander or surfacer? What are the best methods and materials to use in applying a new finish? — *W. C. M.*

A.: The old desk tops should be removed from the frames; be stripped of their old varnish by a light cut through a surfacer; or better by sanding with a cloth belt sander and No. 1 Aloxite K5 as made by The Carborundum Co. of Niagara Falls, N. Y. All holes should be filled with Savogran Crack Filler as made by the Savogran Co., India Wharf, Boston, Mass. A little experimental work should be undertaken to determine just how much dry pigment colors must be added to the colorless crack filler in order that the patch may match the finished wood. When the patch has

dried, sand clean on the belt sander, using a No. O Aloxite K5 cloth belt. Then shellac with a 2-pound cut of either white or orange shellac as desired. When the color is matched satisfactorily, the amounts used can be calculated and the proper amount of dry colors added to a large quantity of the crack filler, shaken thoroughly in a bag to give a good blend and then mixed with water in small amounts as needed. By proceeding in this manner, the color will be uniform throughout the entire job.

Unfortunately you do not say what wood is used in the desks, but from experience I should judge it to be maple or cherry. The specifications then would be as follows:

1. Remove all tops, being careful to leave no exposed screw stubs.
2. Resurface all tops, either with the planer or with a No. 1 Aloxite K5 cloth belt; or with a portable hand sanding machine.
3. Clean out all cuts and scratches, undercutting with a sharp knife slightly in order to give sufficient dovetail for the crack filler to be securely locked in place.
4. Mix up a small quantity of Savogran Crack Filler, tinted to match with dry pigment colors, and force into the cracks with a flexible putty knife smoothed by rubbing occasionally on a piece of fine paper.
5. Belt sand all tops with a No. 0 Aloxite K5 cloth belt to a true and clean surface.
6. Dust off carefully, preferably with an air blast, and take to a separate room. Apply a well brushed out coat of Pratt & Lambert Co.'s 4-hour varnish, letting dry over night.
7. Sand with a split 6/0 paper as close as desired. Revarnish after dusting off carefully. A drying frame of some kind should be constructed so that the tops may be racked about 4 in. apart, starting with the top of the frame. Much cleaner work may be produced on the last coat if a tack-rag is used just before varnishing. The best brush to use for this work, in case a spraying machine is not available, is a 3-in. bear, fitch, or ox hair; double thick, full chisel, varnish flowing brush.
8. The last coat may be rubbed with crude oil and 2/0 steel wool in one direction only if it is desired to remove the high gloss. Clean up with fresh rags.
9. The iron frames should be scrubbed with Painters Savogran; dried and brushed with a good turpentine black japan varnish, applied with a 2-in. black china XXX varnish flowing brush.

Note: Avoid the use of shellac under varnish for this type of work. Varnish used as a sizing material, sanded and given as many coats of varnish as may be necessary to produce the desired result will give better service. Do not get too deep a varnish coating; rather have a tough finish apparently a part of the wood itself. In case it is necessary to stain the tops use Murphy Varnish Co. permanent stain between Nos. 5 and 6, following the sanding operation. — *Ralph G. Waring.*

MR. COOVER PROMOTED TO STATE TEACHERS' COLLEGE

Mr. S. L. Coover, formerly director of industrial education at Beaver Falls, Pennsylvania, has been appointed director of the new teacher-training program for the department of industrial arts at the California State Teachers' College, at California, Pennsylvania. Mr. Coover in his new work has charge of the two training centers established by the state education department, one in the western part of the state at California, and the other in the eastern section at Millersville.

Mr. Coover is well qualified for the work which he has undertaken. He is a machinist by trade, has acted as instructor

MR. S. L. COOVER
Director, Industrial Arts, California State Teachers' College, California, Pennsylvania

in the summer school of the Pennsylvania State College, and is at present completing his graduate work leading to a master's degree at the University of Pittsburgh.

Mr. V. H. Oberlander, of Galion, Ohio, has been appointed as vocational coördinator at Mansfield, Ohio. Mr. Oberlander succeeds Mr. A. W. Bartholomew, who has been appointed regional head of the state department of vocational education.

Mr. Frank K. Phillips, manager of the educational department of the American Type Founders Company, Jersey City, N. J., will have charge of the courses in printing during the Ocean City summer-school session at Ocean City, New Jersey.

Mr. M. C. Gleason has been appointed as instructor of industrial-arts work at the Union School, Palmyra, N. Y.

Mr. Waldemar Kaempffert, director of the Museum of Science and Industry, Chicago, Ill., is the author of a reading course, "Invention and Society," which is being published by the American Library Association.

In the course which relates invention to historical and social development, Mr. Kaempffert recommended for further reading, books which expand these ideas, as well as discuss the lives of great inventors, their achievements, and their rewards. Groups working in industrial laboratories are viewed by Mr. Kaempffert as successors of the "wizards" of the past. He points out that the individual inventor of the future may be unable to compete with such groups who have at their disposal, splendid laboratories, time, and money, and who may work for a number of years before producing noteworthy results.

Mr. Kaempffert, before becoming director of the museum founded by Julius Rosenwald, was managing editor of the *Scientific American*, editor of *Popular Science*, and the author of *The New Art of Flying* and *A Popular History of American Invention.*

Mr. Halbert W. Miller has been reëlected as state director of vocational and agricultural education for the state of Arizona. Other officials reëlected were Mrs. Mildred Weigley Wood, state supervisor of home economics; George S. Sanders, supervisor of trades and industries; and Mrs. Grace F. Kenner, state supervisor of civilian rehabilitation.

Mr. W. G. Koppelo has been reëlected as instructor in manual training at Onawa, Iowa. Mr. Koppelo has completed sixteen years of service at Onawa.

STANLEY
NAIL HAMMER
Six weights 5 oz. to 20 oz.

STANLEY TOOLS

What do you look for in a Nail Hammer *for your shop?*

Aren't these four points and the trade mark the important things that you should consider when you are selecting Nail Hammers for your shop?

1. Balance and Design

   Stanley Nail Hammers are correctly balanced for easy use. Their distinctive design assures this balance.

2. Claws

   The claws of Stanley Nail Hammers are so beveled that they will grip and pull a nail by the shank.

3. Handle

   The handles of Stanley Nail Hammers are turned from young, straight-grained white hickory thoroughly seasoned. The end of the handle is oil treated to eliminate shrinkage — the usual cause of loose hammer heads. They are shaped to fit the hand exactly.

4. Wedging

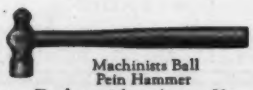
   Stanley Nail Hammers have two special wedges with teeth on each side that fasten the handle securely to the head. The eye is double tapered, locking the handle in place.

Stanley Equipment is Standard Equipment

THE STANLEY RULE & LEVEL PLANT
Educational Department
New Britain, Conn.

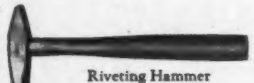
STANLEY TOOLS

Other Stanley Hammers for the School Shop



Machinists Ball Pein Hammer
Twelve weights: 4 oz. to 56 oz.

Blacksmiths Hand Hammer
Six weights: 26 oz. to 72 oz.



Riveting Hammer
Six weights: 4 oz. to 18 oz.

Upholsterers Magnetic Tack Hammer

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ASSOCIATION & CONVENTION ACTIVITIES

THE APRIL MEETING OF THE BOSTON VOCATIONAL SOCIETY

The Vocational Education Society of Boston held its monthly meeting on Saturday, April 12, at the Hotel Westminster, Boston, Mass.

At the meeting, Mr. Willis C. Brown presented the society with a gavel made of wood taken from the Faneuil Hall.

Mr. William Moore, the first speaker on the program, took as his subject, "The Lexington Airplane Carrier," describing the purpose and method of constructing the ship. He said it was the largest device of this kind ever moved under its own power, and required seventeen tugs to dock it. Its hangar is capable of holding twenty airplanes and it is equipped with a machine shop, a foundry shop, a pattern shop, and an instrument shop.

Mr. John Black, the second speaker, discussed "Building Racing Yachts," a hobby which he has followed for a number of years. He predicted more activity along this line in the future and showed some models of boats made by boys in the fifth grade.

Mr. Willis C. Brown, another speaker, gave an interesting talk on "Building and Flying Model Airplanes," explaining how the model airplane clubs came into existence. He comments on the different tournaments and competitions in which the boys had participated and spoke of the ability to build scale models of famous planes.

The meeting adjourned with a vote of thanks to the speakers who had contributed to the program. — *Louis A. Van Ham.*

NEW YORK SCHOOL CRAFTS CLUB MEETING

The regular meeting of the School Crafts Club of New York City was held on Saturday evening, April 12.

Mr. Fred Thompson, supervisor of special activities at Paterson, N. J., gave an interesting talk on "The Changed Aspect of Manual-Arts Education," taking up the history of the manual-arts movement and the development of the work during the past few years. He pointed out that the acquisition of skill is not the aim of manual-arts instruction, nor the ambition of the students, and contended that it has been largely through a misconception of the purpose of manual arts that the work has been so severely criticized and in many cases termed a failure. He showed that manual-arts instruction has come to mean wider opportunities for the student for increasing his general education and his knowledge of the world in which we live. The teaching profession today, he said, demands a teacher of wide knowledge and varied experiences, one who is able by training and experience to bring to the students information which is alive and interesting. He urged that instruction be given in the sources of supply, manufacturing, transportation and distribution, bringing the pupils into contact with science, geography, and commerce. Some attention was given to such phases of the work as try-out courses for the junior high schools, general shops for the senior high schools, vocational guidance, and handy jobs.

Mr. Saunter, of East Orange, presented some interesting illustrations of tests used in the schools.

Mr. Fred Arnold led in the discussion which followed.

The next meeting will be the annual meeting. — *N. A. Crow.*

THE GRAND RAPIDS CONVENTION

Hotel Pantlind at Grand Rapids, Michigan, was the scene of great activities on April 24, 25, and 26. Investigation showed that this activity was all due to the vigorous on-

(Continued on Page 22a)

From the Atlantic to The Pacific

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The School Shop of the
Thomas Nelson Page Junior High School,
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"Oliver" machines are built with the thought in mind that "Every satisfied customer is a booster." That's why Oliver has so many boosters. "Oliver" machines are designed and constructed by experts and you can be sure that when your shop is "*Oliver*" equipped it is *well* equipped.

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MAKE BETTER MECHANICS

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You may send "Yankee" Tool Book (offered in Industrial Arts) —Showing Spiral and Ratchet Screw-drivers, Automatic Push Drills, Ratchet Braces, Socket Bit-Extensions, Ratchet and Plain Breast and Hand Drills, Automatic Chain and Bench Drills, Ratchet Tap Wrenches, Continuous-Work Swivel Vises, Plain Screw-drivers, Etc. *(Please clip and write name and address in margin below)*

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slaught of the Michigan Society for Manual Arts and Industrial Education on the problems which confront them in their daily work in the schools of their state.

The retiring officers, consisting of George B. Frazee, Jr., president, and A. C. Tagg, vice-president, as well as the able secretary-treasurer, Earl L. Bedell, deserve great credit for the fine program which they had set up for the convention meetings.

The convention tours to schools and industrial plants were judiciously planned and therefore well patronized. The general assemblies and the three banquets were as enjoyable as they were instructive. There were no dead spots on the program.

The program for the round-table conferences contained topics that could not help but be interesting to those who attended, and the subjects were all in the hands of men who were able in a convincing manner to discuss their assignment. The round-table conferences covered the ordinary subjects which one would expect industrial-arts teachers and vocational teachers to be interested in. The program was quite comprehensive, for it included discussions on auto mechanics, coördination problems in part-time and full-time vocational schools, consolidated rural agricultural school manual arts, machine-shop practice, mechanical drawing, manual-arts problems in elementary schools, organization of general shop, printing, related trade subjects, trade education, and woodworking.

The tours to industrial and civic plants included trips to the Wolverine Brass Co., Gypsum Mines, Corduroy Tire Company, American Seating Company, Filtration Plant, Fish Hatcheries, Klise Manufacturing Company, Oliver Machinery Co., Berkey and Gay Furniture Co., Imperial Furniture Company, and Gallmeyer and Livingston.

Besides these tours the commercial exhibits at the headquarters were well patronized, showing the great interest that the teachers of industrial arts and vocational education in the state of Michigan take in all matters pertaining to their work.

At the general assembly dinner on Friday, the main address was given by Dr. R. L. Cooley, director of vocational education, Milwaukee, Wis., who in his usual able manner showed the economic need for giving the right kind of education to that large portion of young Americans who will necessarily have to take the place of the workers in the commercial, industrial, and agricultural activities of this country. At this meeting K. G. Smith, state supervisor of industrial education, was presented with a life membership in the American Vocational Association by the members of the Michigan Society for Manual Arts and Industrial Education.

At the general assembly Saturday morning, the new officers for the coming year were installed. A. C. Tagg, director of industrial education, Dearborn, was elected president; L. R. Abbott, director of manual training and industrial education, Grand Rapids, vice-president; and Earl L. Bedell, secretary-treasurer.

The revision of the constitution was also taken up and among the changes made was the adoption of the new name for the organization, which will henceforth be known as the Michigan Industrial Education Society.

A WORTH-WHILE JOINT MEETING

Members of the Arkansas Valley Manual-Arts Club and the Tulsa Manual-Arts Club held a joint meeting and banquet at the Quah-ta-see-da Club at Ponca City, Okla., on Saturday, April 5. About fifty members from the two organizations attended. Mr. Dewey, of Ponca City, acted as host, while Mr. Harry McGinnis, of Tulsa, served as chairman.

The general subject of the meeting was "How to Develop Original Thinking." Mr. Carl Nelson, of Newton, Kans.,

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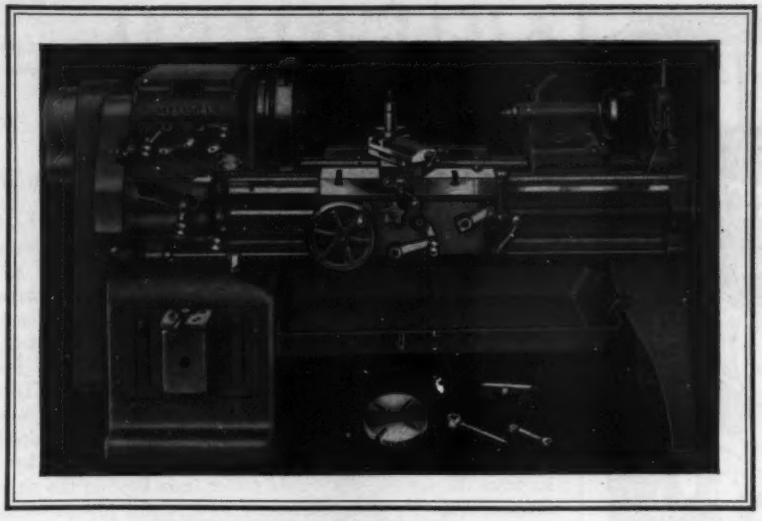

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TIMKEN BEARINGS

(Continued from Page 22a)

spoke on the subject, "How to Develop Original Thinking in Woodworking," urging the men to know their students. Mr. Ralph Coile, of Wichita, talked on "How to Develop Original Thinking in Mechanical Drawing." Mr. Fred Heisler, of Ponca City, discussed "The Possibilities of Developing Original Thinking in the Sheet-Metal Shop." He emphasized that original thinking is most easily promoted where the pupil is following a bent of his own, and that thinking is more easily stimulated when the vocational possibilities of the trades represented are exposed. Mr. Frank Hutchinson gave a short talk on "The Development of Original Thinking in Printing," pointing out that when a teacher knows more about industrial arts, he realizes more how much there is yet to learn about teaching. Mr. Badger, of Tulsa, declared that teachers of industrial-arts subjects are not, as a whole, living up to the possibilities of the industrial arts, and pointed out that more than 90 per cent of the everyday thinking outside of school is about concrete things. The industrial-arts course, he said, is the place to train people how to do this kind of thinking. The schools should turn out thinking boys rather than fine projects.

Tentative plans have made for a meeting to be held next year in Kansas, with the Arkansas Valley Club as the hosts.—*Carl G. Bruner.*

INDUSTRIAL-ARTS ASSOCIATION OF PITTSBURGH AND VICINITY HOLDS MEETING AT PITTSBURGH

The Industrial-Arts Association of Pittsburgh and vicinity held a meeting on April 11 and 12, at the Carnegie Institute of Technology, Pittsburgh, Pa. Dr. G. D. Whitney, head of the University Department of Vocational Education, presided at the opening session. Dr. William T. Bawden talked on "Some Factors for Judging the Quality of Shop Teaching," taking up various conditions outside the control of the teacher, and the characteristics of good shop teaching. Dr. Bawden stressed the importance of the demonstration and the preparation necessary on the part of the teacher before attempting a demonstration. Dr. L. A. Wilson gave a talk, in which he called attention to the present trying period in the work, when more units of instruction are being added and a demand exists for the semiskilled product. Some splendid courses have been developed so that jewelers can be trained in this country. Last year the jewelers of New York City had $59,000,000 worth of jewels on hand, but could not find enough trained workers to carry out the work.

Dr. C. B. Connelley, of the Carnegie Institute of Technology, who was one of the pioneers in industrial training, told of the establishment of the Frick Foundation. Dr. Connelley was of the opinion that the industrial teachers do not know their strength and that the boy who learns to be an engineer, with a background of vocational work, is one of the better kind.

Dr. David S. Snedden, of Columbia University, speaking to over 200 industrial and vocational teachers, said he was of the opinion that units of instruction can be carried on in part-time, coöperative, and continuation schools with considerable success.

Mr. F. J. Coyte, president of the association, presided at the session on Saturday. Mrs. Mary Cowley, the first speaker, said she wanted the industrial-arts men to make a radio by which she can get all the 240 stations without remaining up until morning. Dr. C. R. Allen, of the Federal Board for Vocational Education, and Mr. James H. Greene, of South Bend, Ind., gave helpful talks, in which they emphasized that the school should not be isolated, but should become a part of life. The student should be so trained that he will have something salable when he has completed the course of study.

(Continued on Page 26a)

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New Orleans, La.			

(Continued from Page 25a)

At the close of the meeting, about thirty useful prizes were given out to the winning individuals. The prizes were given by firms having exhibits at the meeting.

Plans are being made to hold the annual meeting in the spring hereafter.—*George C. Donson.*

OHIO VALLEY INDUSTRIAL-ARTS TEACHERS MEET AT WHEELING

The Ohio Valley Industrial-Arts Teachers' Association held their annual meeting at Wheeling on April 11. Mr. S. Grant Conner, apprentice coördinator for northeastern Ohio, explained the state's plan in promoting the training of apprentices in industry. He emphasized the need for industrial-arts and vocational teachers to keep in close contact with industry, declaring that in his experience, school shops were too far behind industry in the matter of methods. Mr. C. C. Hayward, in charge of apprentices at Wheeling, who spoke, was also in agreement with Mr. Connor's statement. He explained that the industry does not expect to receive finished mechanics from the schools, but would rather train boys in the right fundamentals. He placed emphasis on attitudes toward work, employers, and toward society in general.

At the close of the meeting the officers for the next year were elected as follows:

President, Mr. Walter F. Krebs, Weirton, W. Va.; secretary, Mr. R. S. Kay, Wheeling, W. Va. — *Walter F. Krebs.*

HOLD EDUCATIONAL CONFERENCE AT DISSTON PLANT

A unique series of educational conferences was held during the spring at the Henry Disston plant in Philadelphia, Pa. At the conferences, educational representatives of city, state, and federal departments discussed with a group of industrial superintendents some of the practical methods of leadership training and foremanship development.

EDUCATIONAL CONFERENCE HELD AT THE DISSTON PLANT

Mr. G. A. McGarvey, agent in industrial education for the Federal Board for Vocational Education was present. Mr. W. E. Brunton, state supervisor of industrial education for Pennsylvania, spoke for the state, while Mr. C. F. Bauder, director of vocational education, took up phases of part-time apprentice training in Philadelphia school shops. Mr. Sparks, of the Philadelphia branch of the Metal Trade Association, discussed the purpose and scope of his organization.

Among the Disston executives present at the discussion were Mr. George Satterthwaite, vice-president; Mr. Richard T. Nalle, factory manager; Mr. Albert H. Disston, general superintendent; and Mr. Frank Dorsey, assistant general superintendent.